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Contents

ANNUAL RATES OF SUBSCRIPTION.—Farmers, Graziers, and all other persons in Queensland and Northern Territory whose main source of income is from the land; also Schools, Schools of Art, Agricultural Societies and Students in Queensland, **One Shilling.** All others, **Ten Shillings.**

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Event and Comment.

Poison Plants Investigations.

MANY of the deaths of livestock from plant poisoning which occur each year can be traced to plants well known to be toxic. In the sheep grazing areas there are a score or more of plants which are known to be dangerous to stock, and in the cattle raising and dairying districts also there occur many plants which are definitely responsible for stock losses. There are, however, numerous cases of poisoning of which the cause is uncertain, though particular plants may be suspected, and other cases in which suspicion cannot be said to attach to any one plant.

Where a plant is definitely known to be poisonous, livestock owners can to some extent adopt preventive measures to protect their stock from being poisoned. Should the plants be eaten, and sickness result, very often a proven antidote is available. Cases of poisoning which cannot be traced to a known poisonous plant are not so readily treated nor guarded against.

For very many years prior to 1937 the Department was giving attention, though somewhat sporadically, to known and suspected poisonous plants, and some of its earlier officers made valuable contributions to our knowledge of both cause and treatment of plant poisoning. Many obscure troubles, however, defied solution, and in order to make a concerted attack on these problems a Poison Plants Committee, consisting of technical officers of the Department of Agriculture and Stock and the University, was constituted in 1937. The objective of the Committee was to determine to what extent plants are the cause of certain

troubles, what poisonous principles are involved, how the poisons work, and what remedies can be employed. Until wartime conditions caused the cessation of active work on plant poisoning investigations, the Committee had performed valuable work in incriminating or exonerating various plants and in recording a mass of information on plant poisoning generally.

The Poison Plants Committee has now recommenced operations and as far as staff conditions and facilities permit will continue the investigations from the botanical, toxicological and veterinary aspects. Among other important troubles which possibly have their origin in poisonous plants, Georgina sickness, Birdsville horse disease, and Tallebudgera horse disease will be further investigated. It is confidently expected that a concerted attack on these problems will disclose their causes and possibly their remedies.

An Educational Contest.

CONGRATULATIONS to the Upper Burnett newspaper, the "Monto Herald," for initiating a novel competition designed to inculcate the principles of soil conservation in the minds of the young.

The competition takes the form of a contest for model builders, who are required to model a farm layout for an average dairy farm of 300 acres of sloping land in the Monto district, with some flat or creek cultivation. The largest points section is that covering effectiveness of layout from the point of view of soil conservation. Ideas for water conservation are also well rewarded.

The keen competitor will need to inform himself on the principles of soil conservation. This self-education on a subject so vital to farming in Queensland will serve a very useful purpose.

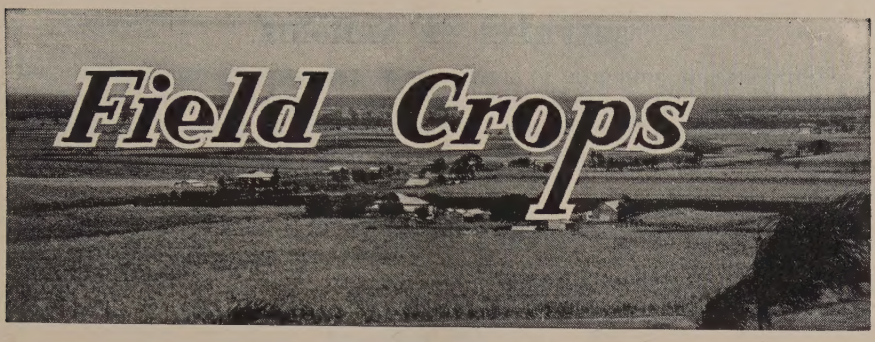
The originators of the competition and those who are supporting it have the commendation of all concerned with the future of Queensland agriculture.

Tomato Seed Certification.

FOLLOWING a period of variety testing and selection of superior tomato plants, the Department of Agriculture and Stock has initiated a seed certification scheme for four varieties.

Announcing that several growers in the Stanthorpe area will be producing seed for certification in the coming summer, the Minister for Agriculture and Stock (Hon. H. H. Collins) said that the original seed had come from crops which had produced high yields of good quality fruit in the Granite Belt. Certified seed taken from the new plantings could be expected to be far ahead of anything else available for the Stanthorpe area for the production of heavy cropping plants of uniform growth and not unduly susceptible to disease.

The four strains included in the scheme are Sioux Q1 (early-maturing), Grosse Lisse Q2 (mid-season), Valiant Q3 (late-maturing) and Rutgers Q4 (late-maturing). They have been selected expressly for Granite Belt conditions and may not be satisfactory elsewhere.



Fertilizer Facts for Farmers.

F. B. COLEMAN, Standards Branch.

THE present Fertilizers Act is based on the experience of past years and came into active operation on 1st January, 1936, when the then existing Act was repealed.

Fertilizers are used for the purpose of supplying to the soil for the use of plants, nitrogen, phosphoric acid, potash, sulphur, magnesia, boron, copper, zinc, manganese and cobalt. All these may be termed the active constituents of the fertilizer in which they are contained.

Because of price, over-concentration, and non-availability to the plant, with the exception of sulphur, these active constituents are applied in compounds or mixtures in which they are present in varying amounts.

The actual "straight" fertilizers that are now upon the Queensland market are—

Nitrate of soda	Superphosphate	Rock phosphate
Sulphate of ammonia	Bone dust	Sulphate of potash
Dried blood	Meatworks fertilizer	Muriate of potash

A large proportion of the fertilizer distributed in Queensland is sold in the form of mechanical mixtures—i.e., mixtures containing two or more of the abovementioned "straight fertilizers" in varying quantities.

The composition of various straight fertilizers is set out in the following, but it should be understood clearly that the proportions vary and the figures given should be taken merely as a guide.

NITRATE OF SODA.

Nitrate of soda, a product of Chile, is a soluble salt that is found in rainless areas. It is mined and passed through various purification processes. Nitrate of soda is a free-running, granular product, much superior to the damp, lumpy material of many years ago. Its composition is as follows:—

	Per cent.
Nitrate of soda ..	97 containing 16·0 per cent. nitrogen
Impurities and water	3
	100 per cent.

In other words, nitrate of soda is composed of nitrogen combined with oxygen and sodium to approximately 97 per cent. with approximately 3 per cent. impurities.

SULPHATE OF AMMONIA.

Sulphate of ammonia is composed of ammonia in combination with sulphuric acid. It may be manufactured in several ways, and has a small percentage of impurities associated with the method of manufacture. Its composition may be set out as follows:—

	Per cent.	
Sulphate of ammonia	97·1	containing 20·6 per cent. nitrogen
Moisture and impurities	2·9	
	100 per cent.	

Sulphate of ammonia of 21 per cent. nitrogen content would naturally have a slightly lower percentage of impurities.

Sulphate of ammonia is either manufactured as a by-product of gasworks or fixed from the air. In simple terms, it is composed of nitrogen and oxygen from the air, hydrogen from water, and sulphur.

ROCK PHOSPHATE.

(Nauru or Ocean Island.)

A good sample of rock phosphate may be analysed as follows:—

	Per cent.	
Tricalcium phosphate ..	87·0	containing 39 per cent. phosphoric acid
Calcium carbonate ..	4·5	
Calcium fluoride	1·0	
Free water	1·5	
Organic matter	0·5	
Impurities: Iron, alumina, silica, insoluble, etc. ..	5·5	
	100 per cent.	

The percentage of phosphoric acid ranges actually from 37 to 39, and 37 may be taken as a safe guarantee. This material is obtained from Nauru and Ocean Islands.

This rock phosphate is used for the manufacture of superphosphate.

SUPERPHOSPHATE.

The process of manufacture involves the grinding of phosphatic rock to a very fine degree, and then mixing two parts to one part of sulphuric acid, which process renders almost all of the insoluble phosphoric acid in the rock phosphate water-soluble.

In other parts of the world superphosphates are obtainable at a cost per ton lower than in Australia but such material has a lower water soluble phosphoric acid content. In Australia the "super" sold is as high a grade as is sold anywhere in the world, excepting, of course, "double super."

Composition of superphosphate—

	Per cent.	
Water-soluble phosphate of lime ..	35	containing 20·5 per cent. water-soluble phosphoric acid
Free phosphoric acid	1	
Citrate-soluble phosphate of lime ..	1·5	containing 0·5 per cent. citrate-soluble phosphoric acid
Insoluble phosphate of lime	2·5	containing 1 per cent. insoluble phosphoric acid
Calcium sulphate (including gypsum)	48	
Moisture	7	
Impurities (silica, &c.)	5	
	100 per cent.	

The following figures, often met with, are explained respectively thus:—

20·5 *per cent. phosphoric acid*: This refers to the water-soluble phosphoric acid present.

22 *per cent. super.*: This refers to the total phosphoric acid—

20·5 per cent. water-soluble
0·5 per cent. citrate-soluble
1·0 per cent. citrate insoluble

22·0 per cent. total

45 *per cent. soluble phosphate*: This is a theoretical calculated figure obtained by converting 20·5 per cent. water-soluble phosphoric acid to tricalcic phosphate, which is the insoluble calcium phosphate (occuring in bone and rock phosphate).

48 *per cent. tricalcic phosphate*: This is a theoretical calculated figure obtained by converting the 22 per cent. total phosphoric acid to tricalcic phosphate.

It should be noted that all the above expressions are used in connection with the one superphosphate on the Queensland market; the only useful figure for comparison, however, is the 20·5 per cent. water-soluble phosphoric acid.

Superphosphate is made in Queensland.

SULPHATE OF POTASH.

The sulphate of potash at present available in Queensland is prepared in Western Australia from alunite, a material containing aluminium as well as potash. After processing, the portion sold as a fertilizer is composed of—

	Per cent.	
Sulphate of potash ..	53	containing 29 per cent. potash (K_2O)
Other sulphates and impurities	46	
Water	1	
	100 per cent.	

CHLORIDE (MURIATE) OF POTASH.

This is composed of—

	Per cent.	
Chloride of potash ..	95	containing 60 per cent. potash (K_2O)
Common salt, sulphates and other chlorides	4	
Water	1	
	100 per cent.	

The potash content varies from 60 to 62 per cent (K_2O).

Our potash supplies come from the Dead Sea in Palestine and from France.

MEATWORKS BY-PRODUCTS.

These materials, being of organic origin—as will be seen—vary in composition. It is possible that materials of different nitrogen and phosphoric acid content from those set out below may be met with.

Blood.—The following composition is typical:—

	Per cent.	
Crude protein	81·25	containing 13 per cent. nitrogen
Moisture, organic matter, etc.	18·75	
	100 per cent.	

Usually the dried blood on the Queensland market contains from 11 to 13 per cent. of nitrogen. Very little dried blood is available as most is used in the manufacture of stock foods.

Bone.—An average quality bone dust is composed of the following:—

	Per cent.	
Crude protein ..	22	containing 3·5 per cent. nitrogen
Tricalcic phosphate of lime	50	containing 23 per cent. phosphoric acid
Moisture, organic matter, etc. ..	28	
	100 per cent.	

Bone dust in Queensland contains from 3 to 3·5 per cent. nitrogen and 22 to 23.5 per cent. phosphoric acid. Generally speaking, the more the bone is subjected to steam heating or sterilizing, the lower becomes the nitrogen and the higher the phosphoric acid.

Highly sterilised bone is sold as a stock food and may contain less than 1 per cent. of nitrogen and over 30 per cent. of phosphoric acid.

Meatworks Fertilizer is composed of flesh, bone, and sometimes blood; it can have the following analysis:—

	Per cent.
Crude protein ..	37·5 to 18·75 containing 6 to 3 per cent. nitrogen.
Tricalcic phosphate of lime	31 to 50 containing 14 to 23 per cent. phosphoric acid.
Moisture, organic matter, etc. ..	31·5
	100 per cent.

It should be noted that as the nitrogen increases the phosphoric acid decreases and *vice versa*.

In explanation of the figures given above, it may be stated that nitrogen may be converted to crude protein by multiplying by $6\frac{1}{4}$.

OTHER MATERIALS.

In addition to nitrogen, phosphorus and potash, there are numbers of elements such as sulphur, magnesia, copper, zinc, boron, manganese and cobalt, which are now assuming considerable importance in agricultural practices.

It has been found that deficiencies of these elements may affect very considerably the intake of nitrogen, phosphorus and potash absorbed by the plant.

Mixtures are now available which contain these ingredients, and the Regulations under the Fertilizers Act prescribe that the amount of these elements and the form in which they occur in the fertilizer mixture shall be stated on the label.

In addition, the practice is now being introduced of incorporating, in certain instances, pest-control materials. An example of this is the use of benzene hexachloride in sugar fertilizer mixtures for the control of wireworm. The amount of benzene hexachloride and the percentage of the gamma isomer—the active constituent—are required to be shown on the label relating to such fertilizer.

MIXED FERTILIZERS.

Having reviewed the chief fertilizers that are used in Queensland to compound mixtures, the task of making up some mixed fertilizers from formulæ can be considered.

As an illustration, consider a mixture of equal parts by weight of the following ingredients:

Material used.	*Containing.*
Sulphate of ammonia ..	20·6 per cent. nitrogen.
Superphosphate	20.5 per cent. water-soluble phosphoric acid.
Blood, bone and offal	5·0 per cent. nitrogen as bone. 16·0 per cent. phosphoric acid as bone.
Chloride of potash	60·0 per cent. potash as chloride.

Amount of Material used.	*Calculated per cent. obtained.*		
	Nitrogen. Per cent.	Phosphoric acid. Per cent.	Potash. Per cent.
25 per cent. sulphate of ammonia	5·15	—	—
25 per cent. superphosphate	—	5·12	—
25 per cent. blood, bone and offal	1·25	4·0	—
25 per cent. chloride of potash	—	—	15
100 per cent.			

The Fertilizers Act requires minimum guarantees to be stated on the label.

A label for the mixture set out above, if offered for sale, would read as follows:—

.....Fertilizer Mixture.

.....lb. net.

5.15 per cent. nitrogen as sulphate of ammonia.
1.25 per cent. nitrogen from blood, bone and offal.
5.12 per cent. phosphoric acid water soluble from superphosphate.
4.0 per cent. phosphoric acid from blood, bone and offal.
15.0 per cent. potash as chloride (muriate) of potash.

Fine.....per cent.

Coarse.....per cent.

Name and address of seller or manufacturer.

"Fine" and "coarse" are explained later.

Now, by adding the various active constituents together, we obtain 6·4 per cent. nitrogen, 9·12 per cent. phosphoric acid and 15·0 per cent. potash. This would be classed as a 6·4–9·1–15 mixture.

These figures should be used always in the sequence of nitrogen, phosphoric acid and potash, and are designated the *grade formula*.

Now, supposing some one desired a 5·1–7·3–12 mixture, it could be compounded as follows:—

Amount of Material used.	*Calculated per cent. obtained.*		
	Nitrogen. Per cent.	Phosphoric acid. Per cent.	Potash. Per cent.
20 per cent. sulphate of ammonia	4·1	—	—
20 per cent. superphosphate	—	4·1	—
20 per cent. blood, bone and offal	1·0	3·2	—
20 per cent. chloride of potash	—	—	12·0
20 per cent. filler (sand)	—	—	—
100 per cent.	5·1	7·3	12·0

From this it must be realised that it is not possible to compound any *grade formula* picked, at random, in such a way as to give a complete ton of fertilizer; *a filler may have to be used.*

Consequently, this aspect should be considered before some *fancy grade formula* is requested. Even if a filler can be obtained for nothing, freight, handling, and mixing costs must still be paid on it.

If this material is to be offered for sale, the label should read—

. . . . . Fertilizer Mixture.

. . . . . lb. net.

4.1 per cent. nitrogen as sulphate of ammonia.
1.0 per cent. nitrogen from blood, bone and offal.
4.1 per cent. phosphoric acid water-soluble from superphosphate.
3.2 per cent. phosphoric acid from blood, bone and offal.
12.0 per cent. potash as chloride (muriate) of potash.
20.0 per cent. sand.

Fine..... per cent.
Coarse..... per cent.

Name and address of seller or manufacturer.

FINENESS.

All organic fertilizers—i.e., blood, bone, and meatworks—depend upon their fineness of division to a great extent for their availability—i.e., the finer they are the greater is the surface exposed, and the more quickly does decomposition take place.

The regulations prescribe the following standards for fineness:—

	Fine. Material that passes through apertures of	*Prohibited.* Material that will not pass apertures of
Bone dust	$\frac{1}{50}$ in. square	$\frac{1}{10}$ in. square
Dried blood, Meatworks, Mechanical mixtures	$\frac{1}{50}$ in. square	$\frac{3}{16}$ in. square
Rock phosphate, Phospho guano	$\frac{1}{60}$ in. square	$\frac{1}{8}$ in. square
Lime	$\frac{1}{100}$ in. square	$\frac{1}{8}$ in. square

"Coarse" material is the particles that are larger than "fine" and smaller than "prohibited."

It should be understood clearly that the percentage of "Fine" and "Coarse" shown on labels of mixtures relates to the organic material only, except in the case of lime, rock phosphate, and phospho guano.

The method of analysis provides that all chemical material (almost completely water-soluble or capable of being broken down by water) shall be washed out, and the organic blood, bone, flesh, and offal only shall be "tested for fineness." The percentage of "coarse" is that portion of the insoluble organic material that is retained on the specified sieve.

FILLER.

Any fertilizer containing a filler must show on the label the percentage of filler. "Filler" is any material, contained in any fertilizer, that does not contain in appreciable quantities an ingredient containing an active constituent beneficial to the growth or health of the plant—for example, earth, sawdust, ashes and antbed.

Fillers are merely added, as explained above, to make the weight of fertilizer up to a ton—or for other less worthy reasons.

A clearer explanation would be—

Sulphate of ammonia is not filler, because it is used to supply nitrogen.

Superphosphate is not filler, because it is used to supply phosphoric acid.

Rock phosphate is not filler, because it is used to supply phosphoric acid.

Sulphate of potash is not filler, because it is used to supply potash.

Cottonseed meal is not filler, because it could be used to supply nitrogen.

Magnesium sulphate is not filler, because it is used to supply magnesia.

CALCULATIONS.

In order to assist in the explanation as to how to obtain the weight of ingredients to use, to obtain a certain guarantee, or the guarantee that would result from the use of any proportion of ingredients in a mixed fertilizer, the method of questions and answers has been resorted to.

Calculations have been made to the nearest pound only.

Question.—How much sulphate of ammonia shall I use in 1 ton to obtain 5 per cent. of nitrogen?

Answer.—Formula to use:—

$$\frac{\text{Total weight required} \times \text{Per cent. of Active Constituent required}}{\text{Per cent. of Active Constituent in Ingredient used}} = \text{Weight of Ingredient to be used.}$$

Calculation—

$$\frac{2{,}240 \text{ lb.} \times 5}{20{\cdot}6} = 544 \text{ lb.}$$

Therefore, 544 lb. of sulphate of ammonia (containing 20·6 per cent. nitrogen) in 1 ton of fertilizer would give 5 per cent. nitrogen.

Question.—If I use 544 lb. of sulphate of ammonia (containing 20·6 per cent. nitrogen) in 1 ton of fertilizer, what would be the percentage of nitrogen present?

Answer.—Formula to use:—

$$\frac{\text{Weight of Ingredient used} \times \text{Per cent. Active Constituent in Ingredient used}}{\text{Total Weight}} = \text{Per cent. Active Constituent present.}$$

Calculation—

$$\frac{544 \text{ lb.} \times 20{\cdot}6}{2{,}240} = 5 \text{ per cent. Nitrogen.}$$

Therefore, 5 per cent. nitrogen, as sulphate of ammonia, would be present in 1 ton of fertilizer containing 544 lb. of sulphate of ammonia.

The various other percentages obtainable from different ingredients would be calculated similarly.

LIME.

The Fertilizers Act applies to lime for agricultural purposes as well as to fertilizers. This has been dealt with comprehensively in a previous issue of this *Journal*.

THE FERTILIZERS ACT OF 1935.

The following are the main requirements of the Fertilizers Act:—

Every dealer must be licensed to sell fertilizer and lime for agricultural purposes (cost £1 1s. yearly).

Every fertilizer or lime must be registered yearly.

Every sale of fertilizer or lime over the value of 10s. must be covered by an invoice and warranty.

Every bag of fertilizer or lime must be labelled.

Every bag of fertilizer must be branded with the brand and name of the fertilizer.

Any buyer who desires to have an analysis made of a fertilizer or lime that he has purchased must give notice to the seller, within fourteen days of delivery, of his intention to have it analysed, and must also comply with the provisions set out in Regulation 15 under the Fertilizers Act.

OFFENCES.

The Fertilizers Act is for the purpose of protecting buyers, and any irregularity, actual or suspected, should be *reported immediately* to the Standards Branch in order that investigation and necessary action may be taken at once.

EXPLANATION OF TERMS.

The following terms, often met with, have the meanings as set out hereunder:—

N	= Nitrogen
P_2O_5	= Phosphoric acid
K_2O	= Potash
Super	= Superphosphate
Sulp. amm. or amm. sulp.	= Sulphate of ammonia
Pot. chlor. .. .. / Muriate of potash ..	= Potassium chloride
Tricalcic phosphate of lime	= Phosphoric acid and lime in combination in the insoluble form

Grade formula expresses the respective percentages of nitrogen, phosphoric acid, and potash in the order given and guaranteed to be present by the dealer in mixed fertilizers, such as 5½–10–12.

Pineapple Culture in Queensland.

H. M. GROSZMANN, Horticulturist.

THE pineapple comes from the tropics and belongs to a family of plants (*Bromeliaceae*) many of whose members inhabit trees and rocks, their shallow roots surrounded by decaying bark and leaf mould. While the pineapple is a ground dweller, it has still the specialized root structures of its tree-dwelling relatives. Like them, it cannot stand poor aeration, and it prefers a soil rich in decaying plant matter. This helps to provide the acid conditions, the mineral nutrients, and the even temperature and moisture which the roots require.

STRUCTURE AND FRUITING HABIT OF THE PINEAPPLE PLANT.

The structure of the plant and its fruiting habit can best be described by referring to Plate 19, which shows a plant bearing a mature fruit.

The dense root system rises from the axils of leaves at the base of the short stem. From this stem radiate fleshy, trough-shaped leaves, and it is from the apex or growing point of the stem at the centre of the plant that the single fruit arises when the plant is sufficiently developed. Only one fruit is borne on the one stem. The subsequent or first ratoon crop is produced by off-shoots called suckers, which grow from the parent stem when it begins to fruit. These bear fresh suckers which, in their turn, provide the next or second ratoon crop, and so on.

Other off-shoots frequently grow from the fruit stalk. These are called slips. At their bases they generally have a small fruit-like structure or "pinelet" which in time decays. Unlike suckers, slips do not fruit as long as they remain on the parent plant.

The "fruit" is really a compound structure derived from a flower spike, and consisting of numerous fruitlets or eyes, each of which comes from a single flower. Through the centre of the fruit runs the core, really a continuation of the fruit stalk, and terminated by a vegetative offshoot, the crown.

In the axil of nearly every leaf on the plant are buds from which new plants could possibly grow, but the chief types of commercial planting material are slips, suckers, crowns or tops, and sometimes the butts or stems which have produced a fruit.

VARIETIES.

There are numerous varieties of pineapples, but only a few of them are of economic importance in Queensland. The main commercial varieties are the Smooth Cayenne and the rough-leaved Queen and Ripley Queen.

Plate 19.

A Plant of the Smooth Cayenne Variety with Leaves Cut Away to Show the Various Plant Parts.—(1) Roots; (2) stem; (3) fruit; (4) top or crown; (5) ground sucker; (6) sucker; (7) slip.

Plate 20.

SUMMER-FRUITING TYPE.—Note cylindrical fruit set low between advanced suckers.

Plate 21.

WINTER-FRUITING TYPE.—Fruit conical and set high on the plant. Note comparative backwardness of suckers.

The Smooth Cayenne is easily the most important, supplying as it does the whole requirement of canned pineapple as well as the greater part of the fresh fruit trade; and it is with this variety that this article is chiefly concerned. In general, however, the other varieties have similar cultural requirements.

Plate 22.

Origin of a Mutation.—A Smooth Cayenne fruit with one normal smooth crown, and another crown which has mutated to roughness.

PLANT VARIATION.

Where plants are propagated vegetatively—that is, by slips, suckers, or any other offshoot, but not by seed—it is the rule that they remain true to type, all offshoots from the one parent producing similar plants.

In any pineapple plantation, however, it is found that there is considerable variation in plant and fruit type. Some plants are obviously inferior to others, and it is clearly desirable to eliminate the inferior ones. To do this, however, it is necessary to know the causes of the variation which exists from plant to plant. These causes are found to be of two main types.

Firstly, there are differences in environment from plant to plant. Where plants flower at different times of the year (Plates 20 and 21)

different plant and fruit development result. Variations in soil conditions also will cause marked changes in plant growth. Where inferior plants are the result of poor growing conditions the remedy lies in correcting these conditions.

The second reason for variation is that while, as stated above, the great majority of vegetative offshoots have the same hereditary constitution as the parent, occasionally an offshoot does appear which is inherently different from the parent type (Plate 22), and its progeny continue to be different. Such a new type is called a sport or mutant, and it is really a new variety. Inferior sports cannot be restored to normal by improving the growing conditions. The only remedy is to see that no offshoots from such types are used for planting material.

Plate 23.

Collar-of-Slips—Extreme Type.—Longitudinal section showing some slips originating from the base of the fruit.

When an abnormal plant is first noticed it is not possible to determine at once whether the abnormal condition is due to environmental differences or to mutation. This can be decided only by growing plants from the abnormal type under good cultural conditions. If the abnormality is environmental it will probably not appear in these plants, while if it is inherent it will. Numerous trials of this kind have been made throughout Queensland plantations, and about thirty mutant types have been found. On the other hand, many abnormalities such as the "Christmas" pineapple, most high-suckering plants, many crippled fruits, and most cases of multiple crown have been shown to be environmental.

Inferior mutants may and do cause considerable loss, particularly if they are not so markedly inferior as to be rejected at once, and if, in addition, they produce a lot of planting material and thus multiply rapidly. Two such types are the collar-of-slips and the "Long Tom." The "dry fruit" type, too, is quite prolific in planting material, but is so inferior that the plant is often pulled out as soon as it is recognised.

Plate 24.

TWO "LONG-TOM" FRUIT COMPARED WITH A NORMAL FRUIT.

Collar-of-slips.

The collar-of-slips type (Plate 23) is distinguished by the presence of slips arising from near the base of the fruit or even from the base of the fruit itself. Usually, though not invariably, there is an excessive number of slips, not all of which, however, arise from the base of the fruit. The fruit, which frequently carries knobs at the base as well as slips, is often small and somewhat tapered at the top. Owing to excessive slip production, suckering is generally greatly retarded. Removal of the slips during harvesting is very troublesome, and tearing of the base of the fruit will result in injury to it. The collar-of-slips type is, therefore, very undesirable.

To eliminate collar-of-slips, no planting material should be taken from the following:—

(*a*) Plants bearing any slips close to the base of the fruit;

(*b*) Plants bearing any slips with the main winter crop;

(*c*) Plants bearing an excessive number of slips under any circumstances (say, more than three in an average plantation or more than five in very vigorous or in "hold-over" plantations).

"Long Tom."

The "Long Tom" type (Plate 24) is distinguished by the length and narrowness of the fruit, which, in addition, is often very knobby. The

fruit usually matures late, and as suckering is further delayed by the heavy slip production the ratoon crop is retarded considerably. The numerous slips are not clustered at the base of the fruit. Often the fruit, though still of distinctive shape, may be of moderate size, but when produced under less favourable conditions it is mostly of inferior type.

PLANT SELECTION.

As mutation is not a frequent occurrence, selection will cause a rapid and lasting improvement in plantations where, through ignorance or carelessness, inferior types have been allowed to multiply over a long period. Still, mutation, while it is rare, does occur and the grower must be on the watch continually to cull out the poorer sports as they appear.

Plate 25.
FRUIT OF DESIRABLE TYPE.

The simplest and quickest method of improving the stock is by mass selection. This involves making a thorough examination of the plantation just before the summer plant crop matures and marking with paint all plants of desirable type. In this first selection not only should distinctly inferior sports be avoided but also any plant which appears below average, thereby eliminating minor defects which may be inherent. All material from selected plants should then be bulked together and grown in a separate area, and the grower should endeavour, by fresh selections and by natural increase from selected areas, to reach the stage where selected plants will supply his whole requirement of planting material.

The type of plant to select is one bearing a cylindrical fruit of good size with square shoulders and base (Plate 25) set low between two or three well-grown suckers, with only a few slips placed well below the fruit.

While the main emphasis has been laid on the elimination of inferior sports, it is quite possible for superior types to arise by

mutation, and even a slight margin of superiority is well worth the selection. The grower noticing any plants which appear outstanding would thus do well to multiply such plants, keeping the progeny of each plant separate.

INFLUENCE OF ENVIRONMENT.

Climate.

The pineapple is adapted to a tropical climate, and when grown in the sub-tropics it must be confined to frost-free localities. Even then the plant often suffers considerably in cold or exposed sites and is almost dormant from May to August, inclusive. Growth occurs mostly in the warm, moist summer weather. In areas where light frosts occur the damage may be minimised by covering the tops of the fruit with woodwool or by covering the whole of the double row with grass. Apart from the risk of frost damage, fruit maturing late in the winter has a marked tendency to develop physiological disorders such as black heart, and this condition is most prevalent in cold, exposed localities.

Extremes of heat, too, can cause extensive damage, and once the temperature reaches 90 deg. F., particularly after moist, cloudy weather, the fruit is liable to sunburning. Fruit lying over on its side is particularly susceptible to sunburn. While this damage is most likely to occur when fruit is nearly mature, there have been cases of severe burning of half-grown fruit as early as November, and burning can occur as late as the end of March. Throughout pineapple-growing districts it is the practice to cover summer fruit with woodwool, paper covers, or grass, particular attention being paid to the side facing the early afternoon sun.

One of the most important factors in pineapple production is the seasonal distribution of rainfall, which should be such as to provide adequate soil moisture throughout the year, and particularly in the warmer growing months of spring and summer. In Queensland the spring months are generally too dry, and especially so in some of the northern parts of the State. However, in much of the level land of northern Queensland it is possible to remedy this with irrigation.

In southern Queensland probably more damage is caused by excessive late summer rains, leading to waterlogging with its attendant diseases, such as wilt, base rot, and heart rot. This calls for careful drainage.

Aspect.

When grown in the sub-tropics the pineapple likes full sunlight, and does best on a northerly aspect. However, southerly aspects are sometimes used, but under these conditions plants tend to flower later. In a dry season the southerly aspect has the advantage that the soil does not dry out as much as on northerly slopes.

In all situations protection from cold or drying winds is desirable. Cold winds in spring, especially on the basaltic plateaux, may cause a great deal of crippling and cracking of the developing summer crop.

Seasonal Variation in Plant and Fruit Growth.

There are two main flowering periods, namely, the autumn and the spring, and type of fruit and vegetative growth (Plates 20 and 21) are markedly influenced by the time of flowering.

When a plant flowers in spring, say about the middle of September, the inflorescence has been formed in the heart of the plant some time before, that is, during cold, dry weather. The number of flowers or eyes is comparatively small, and the fruit stalk, which develops early, is relatively short. However, the plant now passing into warm, moist growing weather, is able to develop the fruit well, so that it is cylindrical with square shoulders and base, and is generally rich in sugar. The weather is so favourable that buds on the fruit stalk develop into slips, and the suckers are well grown before the fruit is picked in February or March, about five months after flowering.

On the other hand, when the plant flowers in March the inflorescence has been laid down during good growing weather and the flowers are numerous. The fruit stalk is fairly long. However, with the advent of cold, dry winter weather, the sucker growth is retarded, slips fail to develop, and the plant is unable to fill out the fruit, which is generally large but tapers towards the crown, which is small. It has not the sugar content of the summer fruit, and is subject to physiological disorders such as black heart. It takes longer to mature, and is not picked until the middle of September for the "winter" crop—that is, about six months after flowering.

In addition to the two main crops there is a sprinkling of flowering throughout the year, and the plant and fruit type show a progressive change from one to the other of the two extremes described above.

These seasonal effects are much more pronounced in the sub-tropical areas of south-eastern Queensland than in the tropical north, where the mild winters cause little check to growth.

Soils.

While good crops are grown on a wide variety of soils these soils have one thing in common in that they are all well drained. Of the various types ranging from sands to clay loams the sandy loams are probably the best. The sands are too low in humus and clay to retain sufficient moisture and mineral nutrients, and the clay loams, while they are fertile, tend to retain too much moisture. The sandy loams, which are intermediate, are ideal because they are well drained and easy to work and yet retain moisture and mineral nutrients reasonably well.

(i.) *Soil Drainage.*—A soil is not necessarily well drained because it is on a slope. Drainage is determined more by the texture of the subsoil. Whether on a flat or on a fairly steep slope any soil that has a sticky clay subsoil less than 18 inches from the surface will be poorly drained. Also, the topography of the land, as well as the presence of shelves of rock or clay approaching the surface, may cause small areas of soil of good texture to be waterlogged at times.

(ii.) *Soil Acidity.*—Another important factor is soil acidity. Pineapples prefer acid soils, as high acidity enables the plant to assimilate iron, which is very necessary for healthy growth. Moreover, pineapple roots are adapted to acid conditions, and have even been observed to grow down into the acid juices of the fruit. Acid soil conditions also help to combat one of the most serious of the pineapple wilt diseases.

A simple measure of soil acidity is given by the pH scale, in which the figure 7 represents a neutral condition, while below 7 represents

increasing acidity and above 7 increasing alkalinity. The range most favourable to the pineapple is between pH 4.5 and pH 5. If the soil to be planted has a pH only slightly above 5, it is probable that the acid fertilizers normally in use will correct it. If the pH is above 5.5 the acidity should be increased by applying sulphur to the land in amounts varying from 200 to 600 lb. per acre, the amount depending upon the pH and the texture of the soil. The higher the pH and the heavier the soil the more sulphur is required. A grower can be guided in this matter by plant growth on similar land, but if in doubt he should have soil samples tested by the Department of Agriculture and Stock.

While the pineapple requires acid soil conditions it is known that in very acid soils undesirable changes often take place, especially with regard to soil texture. Consequently, in time it may be necessary to make slight corrective applications of lime; but this has yet to be investigated. In general, heavy liming is harmful to the pineapple, as it tends to make iron unavailable to this plant.

(iii.) *The Humus Content of the Soil.*—Another factor of utmost importance to pineapple soils is the presence of ample humus, which not only affects soil moisture, texture, and acidity, but also plays a leading part in making the soil minerals available to the plant. It is this humus, with its accumulation of minerals, which largely accounts for the fertility of virgin soils. It is the loss of this reserve through faulty soil management which is largely to blame for the poverty of much "replant" land.

Humus comes from decaying plant matter. It can be conserved by planting pineapples closely to shade the soil, and increased by turning in the old crop. It can be both conserved and increased by growing cover crops in the intercycle period.

PREPARATION OF THE LAND.

It is sound practice to prepare the land, whether virgin or "replant," some months before planting in order to reduce weeds as much as possible, as weed control is costly once the area is planted with pineapples.

Virgin Land.

While land is occasionally planted without being stumped, it is more usual to make a thorough job of clearing and stumping, avoiding as far as possible very large fires which damage the soil by burning out the humus and depositing alkaline ash.

Of prime importance in preparing the land is the provision of drainage and the prevention of erosion. A suitable series of surface drains, which removes excessive surface water from the plantation, also serves to reduce erosion by preventing undue concentration of water.

For spring planting land should be reduced to a suitable tilth by August, so that surface drains may be prepared before heavy spring storms are likely and before planting is commenced. The first step is to ensure that any accumulation of water from above the area should be diverted by an adequate drain. Then a series of drains should be provided across the slope with just a slight fall and opening into main drains down natural depressions, if possible outside the plantation. These main drains can sometimes take the form of shallow basins serving as roads, and in all cases they can be grassed with a suitable

grass such as buffalo grass. The distance between drains across the slope depends on the steepness of the slope, being reduced as the slope becomes steeper. Any faults or silting of these drains can be corrected during the first rains.

Accurate contour planting and draining are now being tried extensively in Hawaii, where special harvesting machinery designed to handle large areas planted on the contour has been developed. It is possible that this method of planting might be adapted to our smaller areas. Planting across the slope with little regard to the contours is quite common, as it makes for ease of working on steep slopes, but it has the serious defect that water tends to accumulate at the lowest parts of the rows and to break through, causing considerable erosion. It is preferable to run the rows up and down hill or at an angle of up to 45 degrees to this direction, as by doing this each row drains itself. Whether the rows are planted on the contour or across the slope there will generally be a tendency for soil to accumulate above the top row and to move away from the lower row, which often leads to the collapse of the plants in the latter. This does not happen where the rows run down the slope. It is not yet possible to compare planting on the contour with planting up and down the slope, but it does appear that both are preferable to planting across the slope without regard to contour.

Before planting it is important to plan out rows and headlands for harvesting, and for convenience the length of the rows should not be much more than 2 chains from road to road.

Where it does not conflict with measures for drainage and erosion control, the rows should run north and south so that each side of the row gets its share of sunlight. In northern Queensland, however, an east-west direction may be preferable, as it should help to shade the soil in the inter-row.

Where the land to be planted is rather heavy, or flat with a tendency to water-logging, it is best to plant on raised beds prepared before planting by running deep furrows down the inter-rows and raking in towards the rows.

"Replant" Land.

It is generally considered that replant land is inferior to virgin land. So strongly is this belief held that, in many parts of Queensland, growers prefer to let it lie fallow in grass and weeds for several years while they prepare fresh virgin land at considerable cost.

As the problem of maintenance of fertility cannot be postponed indefinitely by the use of virgin land, it must be overcome.

One of the first measures to be taken is to turn in the old crop, which can be done with either rotary hoe or plough. This results in a considerable return of organic matter and mineral nutrients to the soil. Burning of the old plantings before preparing the land is to be avoided, as this destroys much valuable plant matter. In the absence of accurate information it is probably best on general considerations to leave replanting for at least 12 months after turning in the old planting. This gives the trash time to decompose and allows the soil to settle. It also enables the grower to reduce weeds in the area, and probably helps to reduce plant parasites in the soil.

If the old crop is turned in during the winter the land can be planted with a cover crop such as Poona pea or pigeon pea early in the spring. This cover crop will help to suppress weed growth and to reduce erosion. By shading the soil it will also keep the surface layer moist and comparatively cool, thus reducing harmful oxidation of humus, which is very severe under conditions of high soil-temperatures. A leguminous cover crop will also raise the nitrogen content of the soil. The cover crop may be given a shallow discing after the main summer rains are over, and then a winter cover crop can be planted, to be turned in early in August. However, as winter crops give very variable results, depending largely on residual moisture from the summer rains, it may be preferable to let a perennial legume such as pigeon pea stand until about May. It can then be turned in as part of the preparation for spring planting.

Even with the incorporation of plant matter from the previous crop many "replant" areas have been rather unsatisfactory, and there has been a tendency for the plants to decline rapidly after the first crop. The reasons for this are not clear, but the Department is experimenting with different treatments of the land before replanting is carried out. Investigations are being conducted on the effect of different fallow periods of three months to three years between the crop cycles, together with the use of seasonal and perennial leguminous cover crops. The use of chemicals to combat harmful soil organisms such as nematodes is also being studied.

The use of perennial legumes for periods of up to three years seems to have several advantages over seasonal cover cropping. It entails considerably less work, and does not involve periods of exposure of the land and consequent risk of erosion, weed growth and destruction of humus. It also gives land which has been worked for some years a chance to develop a better structure. One of the most promising plants is pigeon pea, but several species of *Crotalaria* and two other legumes—calopo and stylo—are under observation.

PLANTING.

Planting Material.

One aspect of the choice of planting material has been discussed under plant selection, and the types of planting material were mentioned in the description of the pineapple plant.

The main types of planting material are slips, suckers, tops or crowns, and butts, and any of these, if properly selected and handled, will make good plants.

Whatever plants are used, it is advisable to grade them according to size, placing plants of the same grade together. A small plant has no chance of competing successfully with larger ones planted on either side of it.

Slips.—Large slips, if planted in spring and given good treatment, are almost certain to mature their crop in 18 months. Medium to small slips will need very good conditions to do this, and it is much more usual for them to take two years to produce their crop. A percentage may even "hold over" to two-and-a-half years, but this can be prevented by the use of acetylene or synthetic growth substances to induce flowering. This will be dealt with later.

It must be remembered that the careless selection of slips is largely responsible for the increase of some inferior types of plants such as the collar-of-slips, and the grower should be careful to avoid slips from such plants. Where slips are not required for planting material, they should be removed from the parent plant as soon as possible to reduce competition with the suckers.

Tops.—Summer tops if planted in March and April should be sufficiently advanced to mature a crop in two years. These plants should be handled carefully, and stacked in a single layer, butt end up, in the sun, in order to dry and seal the cut end before planting. On no account should they be heaped in the shade, as they will rot very rapidly. Even with these precautions, should heavy rain fall in autumn soon after planting many plants may be lost from fungal rots. The gaps so created can be filled with slips or suckers in the following spring.

Winter tops, if planted early in the summer, should be sufficiently advanced to mature a winter crop about two years after planting. By delaying planting until about December, the bulk of the plants will probably bear for the summer crop a little over two years after planting and still not be overgrown.

Tops being generally much alike in age and size will naturally tend to fruit more uniformly than slips, which in their turn will be more uniform than suckers; but there are numerous exceptions.

Suckers.—In choosing suckers for planting in the early summer, it is a good plan to wait until the end of September, by which time any suckers likely to flower for the summer crop will have done so. From those suckers which have not flowered, or whose centre leaves show no indication of flowering, well-grown plants can be chosen for planting. It is best to peel some of the base leaves from the sucker to enable the roots to grow out freely. This is often done with slips and tops with beneficial results, but in these cases the need is not as great because the base leaves are not as firm and close. Suckers have the advantage that, in land which is likely to be water-logged at any time, they are not as prone to develop heart rot as are slips and tops. On the average, too, they fruit earlier than the other types of planting material and can be expected to mature their plant crop within 18 months of planting. If suckers are too advanced when planted, they often fruit before they are established, with the result that the fruit is too small and must be broken off and discarded.

Butts.—A plant which has borne a fruit becomes a butt, and such plants, if they have not produced a large sucker, are called first butts. These are quite good planting material. Butts should have their leaves trimmed close to the stem, and they should be planted on their sides in a drill and covered to a depth of about three inches. From one to three plants may appear from each butt and it is usual to let them all grow.

Trimming of Planting Material.

When slips and suckers have to be carried a considerable distance, it is necessary to economise in transport costs by trimming off the leaves to about half their length; but, when transport is no problem, the less trimming that is done the better. Under any circumstances trimming is a serious setback to the plant. Large suckers about to flower, removed from the parent plant during warm, moist summer

weather and planted almost at once without trimming the leaves at all, have been known to produce good fruit. Had they been trimmed, the fruit would have been too small to market. When planting large suckers, it is rarely possible to avoid all plants about to flower, but if these are not trimmed they will probably produce marketable fruit.

Storing of Plants.

If necessary, plants may be stored for several months, but they deteriorate steadily by exhausting their reserves of carbohydrate. They should be stored in single layers, base up, in the shade during dry months but in the open during the wet months of summer.

Plate 26.

A Year-old Planting of Tops, Shown Meeting in the 4-feet Inter-row.

PLANTING DEPTH.

It is not desirable to plant deeply and three inches is generally sufficient, with four to five inches for large suckers. Plants set deeply rarely thrive but develop bunched, narrow growth. The usual method of planting is with a small hoe. Some growers run a furrow, place the plant in the drill, and fill in with a subsequent furrow. This is quick, but it is difficult to keep an even depth of planting. Also, many plants may have earth thrown into their centre leaves, and this gives them a serious setback.

While deep planting is to be avoided, it is difficult to plant small winter tops deeply enough. In such cases it may help to run a small furrow not more than two inches deep. The tops can be planted one-and-a-half inches deep in the bottom of this drill, and when they have

grown bigger the drill can be chipped in. The plants will then be at the correct depth. On no account, however, should a small top be planted so that its heart is submerged.

PLANTING DISTANCES.

The usual method of planting (Plate 26) is in double rows two feet apart with the centres of each pair of double rows six to seven feet apart and the plants at one-foot intervals in the rows. The closer spacing gives about 14,000 plants per acre.

On comparatively poor land and on replant land, the 6-feet spacing of the double row centres is generally sufficient, but on very fertile land where growth is vigorous it may be necessary to adopt a 7-feet spacing. With the wider spacing it is possible to plant a single row of large plants down the centre of the 5-feet inter-row, this row to be removed after it has matured its first crop.

Some growers prefer to plant in single rows about five feet apart, believing that this makes for easier weed control. However, this advantage is offset by the greatly reduced number of plants per acre and hence lower yield.

In general, close planting plays a large part in conserving moisture. As the pineapple plant itself uses little moisture in comparison with most other plants, much of the moisture lost from a plantation is either through weed growth or by evaporation from the surface of the soil. With close planting the ground is shaded and air movement lessened, and thus the losses by evaporation are greatly reduced. Like a mulch, close planting brings about a moist condition in the better aerated and more fertile surface soil, and this is the zone in which the pineapple roots can best thrive. Close planting also tends to retard weed growth, thus further reducing moisture loss from the soil.

PLANTING TIME.

It is best to plant medium to large slips and suckers in readiness for flowering the following spring. August is a particularly good month to plant. Though growth will not commence until September, the plants will be ready to root with the first spring storms.

Other plants should be planted so that they may be sufficiently well grown to flower for the first possible summer crop. Some reference has been made to this in the description of planting material, and will be mentioned again when control of cropping is being discussed.

In the main pineapple growing areas of southern Queensland, some planting goes on throughout the summer and also in the latter half of March and throughout April, when the bulk of the summer crop has been picked. For summer tops, and for medium to small slips and suckers, this autumn planting ensures that the plants will be at the right stage for maturing a summer crop nearly two years after the time of planting. This practice has its disadvantages, however, in that handling the summer crop together with the rainy weather of this period makes it difficult to prepare the land. Also, rainy autumn weather after planting may cause considerable loss of plants from fungal rots.

In parts of northern Queensland where irrigation is not available, some growers prefer to leave their planting until about December, as

the very dry weather of spring and early summer does not favour early planting. Even with such late planting, the winters are so mild that it is possible to have plants sufficiently developed to flower in the following spring.

Plate 27.

A Planting 10 years old and still Productive. This is not the Rule.

PLANTATION MANAGEMENT.

Plantation Planning.

To maintain even production, it is necessary to plant about the same area each year. It is generally considered that, with a little help at peak periods, one man can handle about five acres of land. Ideally, this area should consist of five plantings each of one acre, ranging from the youngest area, not yet producing, to the oldest area, from four to five years old. With eight acres of land suitable for pineapples, it should be possible to maintain such a programme, providing for an intercycle period of up to two years and allowing for some extension of the life of any planting which maintains its productivity beyond the usual period of about five years.

To give some idea of the production which can be obtained from such a plantation, an instance can be cited where a grower who maintained an area of about five acres averaged about 2,400 cases per year over a period of six years. Furthermore, most of his land had been in production for many years. While this is well above the average, it is considered that land suitable for pineapples should, under good management, average not less than 400 cases per year for each acre in production.

The Crop Cycle.

While plantations have been kept growing continuously without replanting for as long as 50 years, it is now generally considered that the second ratoon crop marks the end of the economic life of the average planting. This gives a period of from five to six years from planting. There are some areas of more fertile soil, where plants may be allowed to ratoon longer (see Plate 27), the quantity and quality of the fruit being the best guide; but, in general, the decrease in the amount of fruit, and its decline in size, together with the difficulty of harvesting, make plantations unprofitable after this time.

Weed Control.

Weeds in the plantation are generally controlled by hand cultivation, using the Dutch hoe and sometimes the chipping hoe. Some growers who have fairly level land use rotary hoes, or even horse-drawn implements such as scufflers; but such cultivation must be kept very shallow and done very carefully, otherwise considerable injury to the roots will result. This is particularly harmful if it occurs in the cooler months of autumn and winter after root growth has ceased, as the plant will then have insufficient roots to carry it through the dry months of early spring. Another objection to the use of the rotary hoe for weed control is that the fine tilth it produces increases the risk of erosion.

Whatever implement is used, great care must be taken to avoid injury to the stem of the plant.

Weeds compete with the plant for soil moisture, and as they can also compete strongly with young plants for light young areas should be kept very free from weeds. If young and mature plantings are both in need of cultivation, the young plants should always receive priority.

By chipping weeds while they are small, less work is necessary and, if weeds are controlled thoroughly in this way during the early life of the plantation, subsequent weeding costs are reduced.

It is well to remember that plants taken from neglected and overgrown areas will introduce a large number of weed seeds. Generally it is an unsound practice to let an old area go to weeds before removing the plants; not only will the plants be the worse for this treatment and covered with weed seed as well, but the replant area will also be heavily seeded with weeds. With such an area it is best to remove all possible fruit and plants before the plantation has deteriorated too far, and then promptly turn in the remaining plant matter. A cover crop should then be planted to forestall the weeds. Weeds are particularly difficult to control in replant land, but much can be done in this respect during the preparation of the land. Paper mulch has also been used to help control weeds, and to conserve moisture, but it is rather costly.

In many ways, a mulch of grass and weeds appears to be superior to paper mulch, as it allows the entry of rain water and ensures a freer exchange of gases in the soil. It gives lower surface temperatures in summer, encourages surface rooting, and, on decomposition, is a valuable addition to the soil. To supply this mulch, it would probably be a sound proposition to bring in material like blady and other grasses and even light brush from outside and possibly also to grow material such as Sudan grass for the purpose.

Even if it is not possible to mulch the whole area, the grower might well mulch the area in the double row, as well as a strip of about nine inches just outside the plants. The labour involved in mulching is considerably offset by the reduction in chipping, and it must be remembered that mulching reduces erosion while chipping tends to increase it.

To be fully effective, mulch must be applied heavily, at least four inches deep. While a light mulch does conserve moisture and reduce erosion, it actually increases weed growth. Another point is that mulching with old grass and weeds may at times cause some competition for nitrogen. However, this can easily be remedied by applying extra sulphate of ammonia if the plants appear to be losing colour. If there is much likelihood of frost the ground should not be mulched, as this increases the risk of frost injury, but, of course, it is not advisable to grow pineapples at all in such circumstances. Mulching also increases the risk of fire, but this danger is always present in older plantings even without mulch.

Altogether weed control looms very large in production costs, and the position is aggravated by the fact that normal control measures fail during protracted periods of wet weather. If young weeds could be controlled at such time, possibly with flame or with selective weedicides, a great benefit would be conferred on the industry.

Hilling Up.

Where plants have suckered high, it often helps to plough a deep furrow down the inter-row and to shovel soil up to the plants. This tends to support the plants, which might otherwise collapse when fruiting. It also induces new roots above the old root system. This is particularly useful where plants are likely to wilt some months after roots have been killed by excessive rains. Such ploughing should be done during warm growing weather, and preferably while the soil is moist enough for the plants to make new root growth rapidly. The development of new roots may be helped considerably by stripping away a few of the lowest leaves before the hilling up is commenced. The need for hilling up is due to previous neglect, as high suckering is the result of failure to control flowering, and inadequate drainage is the chief cause of wilt.

Patching Up.

In many vigorous plantations, small areas of weakness develop, due possibly to some high-suckering plant falling over, or to a few plants wilting or dying from some other cause. Such patches are unproductive, and it is often possible to replant them with large suckers. For this purpose, suckers which have developed too high on the parent plant can be used.

When plants have fallen over they may be helped to produce both fruit and suckers by putting a small amount of earth on the base of the prostrate plant. A little mulch of grass or weeds, too, will help to provide good conditions for rooting and will reduce the harmful effects of exposure.

Fertilizing.

Except on the most fertile soils, pineapples benefit by large applications of artificial fertilizer, as much as one ton per acre being

applied yearly. The fertilizer for pineapples should have a relatively high content of nitrogen and potash, while the level of phosphate should be comparatively low.

In order that the plant may have a continuous supply of fertilizer during the growing season, when it can best be utilized, the fertilizer should be applied during the spring, summer and autumn months. The annual quota should be divided into several applications. If it is applied in a single dressing much may be lost by leaching, or be locked up, temporarily, by chemical or bacterial action in the soil, and thus not be available when required by the plant.

While the condition of the plant is a useful indication of its fertilizer requirements, it is not wise to delay fertilizing until pronounced deficiency symptoms are apparent. Fertilizing should be a routine practice as soon as the plants are established. The following table gives a guide to a suitable programme.

Period	Fertilizer	lb. per 1,000 Plants
September	10–6–10	50
November	Sulphate of ammonia ..	30
January–February	10–6–10	50
March–April	Sulphate of ammonia ..	30

The fertilizer is applied by hand, and with a little practice the grower should be able to judge how many plants can be treated with each handful. Fifty pounds per 1,000 plants is roughly equivalent to a handful to three plants. The fertilizer should be thrown into the base leaves or on to the base of the plants, as this allows water running down the leaves after the lightest showers to carry it into the soil. It is not necessary to wait for rainy weather before fertilizing. Fertilizer should not be thrown on the younger leaves of the plant, as it will burn them severely.

In fertilizing ratoon patches, it must be remembered that there are many more plants per acre, and that the area will consequently require more fertilizer.

Young plants well supplied with nitrogen should appear predominantly bluish-green in colour, with only a dull purplish-red at the centre of the leaf. As the plants mature they become greener, and the reddish colour becomes more pronounced with the approach of the flowering stage. This is a natural change; but should the green turn towards yellow and the red become too vivid at any stage of plant development, this is an indication that the plant requires nitrogen.

However, the response in growth and colour which so often follows the application of nitrogen as sulphate of ammonia should not be taken to indicate that this is the only fertilizer required. A correct balance of nutrients is needed, for, if the plant receives excessive nitrogen before flowering, the fruit tends to develop abnormal growth, with double, multiple and often fasciated crowns.

Trace Element Deficiencies.

While good growth can generally be obtained by adding the three main fertilizer constituents, the plant requires several other minerals in lesser amounts, some in very minute amounts. Most soils are

adequately supplied with these minerals, but occasionally one or more of them is either lacking or unavailable owing to some special soil condition.

"Crook Neck."—In some of the sandy coastal soils, young plants develop a peculiar disorder. The leaves turn a waxy greenish-yellow colour and bunch together. Frequently these bunched central leaves are bent almost to the ground, giving to the condition the name "crook neck." This disorder can be cured by applying copper sulphate and zinc sulphate incorporated in the 10-6-10 fertilizer mixtures at the rate of about 56 lb. of each to each ton of the complete mixture.

Plate 28.

A "Hold-over" Plant, Tall as the Result of Delayed Fruiting.—Note the great development of slips and the high suckers, many of which will collapse on fruiting.

Iron Deficiency.—Iron, a mineral essential to the green colouring matter of the leaves, is an example of trace minerals which are not available to the plant because of special soil conditions. Sometimes on red basaltic soils plants turn yellow, and it has been found that this is due to a deficiency of iron, brought about by the presence of excess manganese. The condition can be corrected by applying a 3 per cent. solution of sulphate of iron in water, as a mist spray over the leaves. A pound of iron sulphate to a 3½-gallon knapsack spray gives this strength. Care should be taken to secure a fine mist spray, which is applied at a walking pace. A mist spray gives a better cover than a coarser spray and reduces the risk of burning, which occurs if the

spray coalesces into drops and runs down the leaf. Applications should be made at intervals of about four weeks during the summer months, and six to eight weeks during the cooler months. It is, however, best to be guided by the colour of the plants and to make sure that no serious loss of colour occurs.

The same yellow or chlorotic condition due to lack of iron can be caused also by heavy liming.

CONTROL OF FRUITING BY THE USE OF ACETYLENE.

In describing the cropping habit of the pineapple, it has been pointed out that there are two main cropping periods—February-March and August-October—with a comparatively light crop being produced throughout the rest of the year.

The type of fruit matured during the midsummer and autumn months is superior to that produced in winter and the sucker growth is also better. Furthermore, serious physiological disorders of the fruit such as black heart are likely to develop in the winter crop. It is better, therefore, to have plant crops fruiting uniformly for the summer crop. Winter requirements of fresh fruit will naturally be supplied by the ratoon crops.

Uniform summer plant crops are not, however, the rule. Often, though the plants are quite well grown, only 30–50 per cent. of them flower during September. The remainder may not flower till the following autumn and spring (this is known as "holding over;" see Plate 28), and will then be very large with high suckers. This is a serious defect and generally leads to a collapse of the area. Also, the delay in fruiting is a distinct loss, and the uneven fruiting complicates cultural operations.

It is fortunate that, in the use of acetylene, the grower has at his disposal a simple means of controlling flowering. By the end of September, most plants which are going to flower in the spring period will have done so. Those that have not, provided they are large enough to carry good fruit, can be treated with acetylene during October, when they will flower in six to eight weeks' time and mature their fruit during late April and May. If necessary, the crop can be spread to some extent by treating different sections at intervals of a week or a fortnight. Also, the gap between the main summer crop and that produced by the acetylene treatment may be reduced by treating the whole patch early in September, even though it may not then be possible to tell what plants will flower naturally.

Acetylene may be applied either as granules of calcium carbide or dissolved in water. Small granules of the ordinary carbide of commerce may be dropped into the heart of the plant, where they will liberate acetylene. Alternatively, a solution of acetylene may be prepared by throwing a medium handful of carbide into a 4-gallon tin of water. When the carbide has nearly stopped bubbling, the plants can be treated by pouring about one-third of a cupful of the solution into the heart of each. It is generally considered that this is the more effective treatment. Whichever method is used, however, it is advisable to repeat the application if heavy rain falls within 24 hours, though falls of 20 points within 12 hours have, on occasions, had little effect. Acetylene may be used to regulate the cropping of the ratoon areas, but, owing to the

variation in the size and age of the suckers, it will not be possible to obtain a complete ratoon crop in one season. It is especially useful, too, in getting all available fruit from an area which is to be turned in. Another use, very important to the small grower, is the spreading of the crop in such a way as to avoid peak crops and the extra labour these entail.

Acetylene may be applied in February and March to bring in a crop in November and December, but unless the locality is warm and sheltered and generally favourable this is not advisable. When fruit matures naturally in November and December, a large percentage is of poor type, misshapen and cracked owing to unfavourable growing conditions, and it is not wise to expose more fruit to these conditions by using acetylene. It is also unwise to treat plants which are too small to bear a good-sized fruit. Acetylene can make a small plant flower, but it cannot make it bear a large fruit.

When used judiciously, however, acetylene is invaluable in regulating fruiting, spreading the crop and controlling plant growth, and it could be used more widely with advantage. In addition to acetylene, plant stimulants of the hormone type are being tested and they promise to give even greater control of flowering and fruit development. Experiments have indicated that alpha-naphthalene-acetic acid, one of these chemicals, is very effective in inducing flowering, even at the very low concentrations of about one-sixth of an ounce in 200 gallons of water. However, double this strength is recommended until further information is available. The above amount is enough to treat about 20,000 plants, using about one cupful of solution to six plants; at the higher concentration the cost for chemicals is not more than 10s. per acre.

HANDLING THE CROP.

The fruit is harvested when it is beginning to ripen, the stage at which the fruit is picked varying with the season and the distance of the plantation from available markets. The right stage at which fruit should be picked is indicated by the shape of the fruit and by changes in colour. As the fruit begins to ripen, a yellow colour develops at the centre of the lower eyes, then in the whole eye, and eventually extends towards the top of the fruit. External changes associated with ripening of the pulp differ from locality to locality and vary with the season and the age of the plantation. During the summer, fruit is often quite ripe when the external colour is only slightly yellow at the centre of the basal eyes, while in winter fruit is not ready to be picked until it is half-coloured. However, even for the most distant markets summer fruit should not be picked until definite signs of yellowing appear at the base, and in the winter the fruit should always be allowed to remain on the plant until it is half-coloured.

During the wet summer months, a great deal of fruit is lost from soft rots which occur during transport and storage. The chief cause of this rotting is fungal infection by the water blister organism, which

enters the fruit either through injuries caused by careless handling or through the base of the core where the stalk has been snapped off. These losses can be almost entirely prevented by keeping the shed clean, by careful handling and by cutting the fruit stalk instead of snapping it.

Fruit should be cut from the stalk and carried in a basket to the nearest road or headland. Whatever method is used to carry it to the packing shed, great care should be taken to prevent jolting or bruising.

As the water blister fungus develops on rotting pineapple waste, old fruit and heaps of tops, no such refuse should be allowed to remain either in or near the packing shed, and the shed should be periodically disinfected by spraying out with a 5 per cent. solution of formalin. Slides or other vehicles used to carry in the fruit should also be sprayed occasionally.

If the fruit is picked during hot weather it is an advantage either to pick it in the morning or to let it stand in the shed for a time, preferably overnight, before packing and consigning it to a distant market. Also, if it is picked during wet weather it should be stood on its crown and allowed to dry as much as possible before it is packed for the fresh fruit trade.

All fruit should be carefully graded, but fruit for the fresh fruit trade needs to be packed more carefully than is the case with canning fruit. The former is packed "tops on" with woodwool padding, while the canning fruit is packed without the tops and without woodwool.

The importance of handling the crop carefully has been stressed, as neglect in this direction may undo much of the work that has gone into the plantation. A little extra care will avoid this and will result in a higher price for a sound and attractive article.

RED SPIDER IN STRAWBERRIES.

Red spider infestation of strawberry crops is rather severe this year and threatens to reduce the bearing life of many plantings. Control measures for this pest of strawberries require careful attention during the whole growing period, for once the pest gets out of hand it is difficult to clean up the infestation. Dusting with sulphur at fortnightly intervals up to flowering and occasionally after heavy fruit picking during the cropping season is normally satisfactory. However, when control measures have either not been applied before harvesting commences or have failed to give the required degree of control, it is necessary to pick the crop heavily and then immediately apply a sulphur dust. Provided the plants are irrigated with overhead sprays before the next picking day, residues should be negligible and reasonable red spider control will be obtained. An alternative to sulphur dust is a hexaethyl tetraphosphate spray which is marketed under the name "Hexone." This spray is used at a concentration of 1-1200 but it is essential to treat the plants thoroughly in order to ensure that the leaf surfaces where the mites occur are completely wetted.

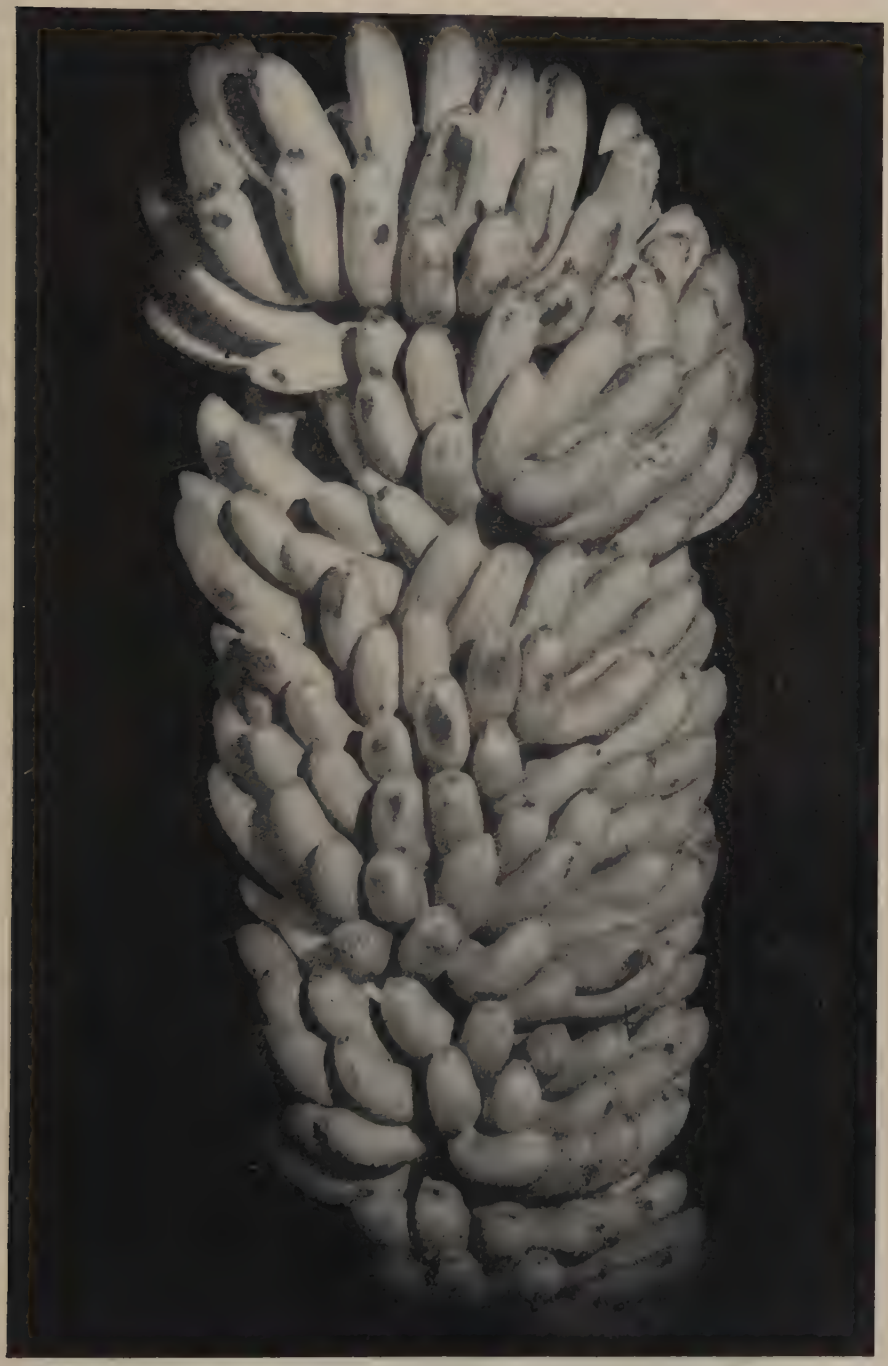


Plate 29.

Record Bunch (Approximately 20 Dozen) of Bananas Grown in Queensland.—Type: "William Hybrid;" weight: 132¾ lb.; grown by George Chester, Pimpama. The massive bunch was presented to the Montrose Home for Crippled Children.

PLANT PROTECTION

Crinkle Virus Disease of Strawberry.

T. McKNIGHT, Pathologist, Science Branch.

IN the main strawberry production areas of Queensland last year the effects of "crinkle" virus disease were severe enough to arouse the concern of growers. The disease was present in varying degrees in all commercial plantings inspected and occurred occasionally in epidemic proportions.

Overseas and in other parts of the Commonwealth the degeneration or "running out" of certain strawberry varieties has been traced to the gradual building up of worthless virus infected stock. It behoves growers to recognise the importance of the strawberry virus diseases, to familiarize themselves with the symptoms they produce and to put into operation the measures recommended to assist in the building up of high grade planting material.

As with many other virus diseases, the danger with strawberry crinkle disease lies in the fact that affected plants are not killed outright

Plate 30.

CRINKLE-INFECTED PLANT, SHOWING PUCKERED AND MOTTLED LEAVES.

and they may continue to yield to some extent. A very real decline in the quality of planting material commences when crinkle infected plants are allowed to remain in position after the runner beds are established.

Unlike the strawberry "yellow-edge" virus, which shows its symptoms in winter, the crinkle virus is most readily identified in the warmer months, and last season the virus was readily recognised in commercial plantings between the months of September and January.

Plate 31.
Young Infected Leaves showing Small Clear Spots.

Symptoms of the Disease.

A strawberry plant in an advanced stage of infection with crinkle virus is a dwarfed plant readily detected from its healthy neighbours. The plant has a flat, bunchy type of growth with crinkling and puckering of the younger leaves, on which occur yellowish areas of irregular shape (Plate 30). Occasionally these yellowish areas form conspicuous bands or sectors running from the margin of the leaf along a vein towards the main vein. If the youngest leaves on such a plant are held up to the sun small clear pinpoint spots will be noted and some of these will have a brown dead centre (Plate 31). Most of the mottled leaves do not have the normal flat leaf blade but tend to be cupped upward or arched downward, and exhibit an irregular waving of the leaf margin. In the earlier stages of infection the symptoms are not so obvious, but a careful examination of a suspicious looking plant will reveal that the leaves have not a good uniform green colour or a smooth leaf surface, and the young developing leaves will show the small clear spots mentioned above.

Method of Spread.

This disease is inherited. When a mother plant is infected with the crinkle virus all of the runner plants derived from it will be similarly infected. The disease is also spread from plant to plant by the commonly occurring strawberry aphid, which becomes infective after feeding on a diseased plant. Unlike a number of well-known virus diseases, crinkle is not spread mechanically during picking and cultural operations.

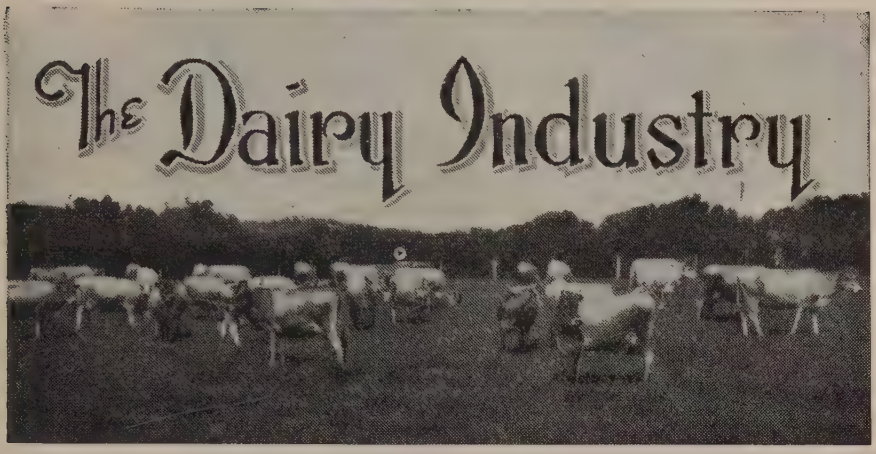
Control.

Once a plant is infected with the crinkle virus there is no cure. With a knowledge of the methods by which the disease is spread, measures for control are aimed firstly at the elimination of the disease from planting material, and secondly at the prevention of spread by the strawberry aphid.

The selection of healthy runners is the most important measure. This should be commenced by frequent inspections of the beds, starting in August and maintained until the runner beds are established, so that infected plants can be removed immediately they are detected. As it is sometimes difficult to make a definite diagnosis of crinkle disease in the earliest stages of infection, the policy of the grower whose aim is the establishment of a high-grade foundation stock should be to rogue all abnormal plants over the whole of the growing season in order to cull also yellow-edge plants occurring during the cooler months.

The need for a careful check on the strawberry aphid is obvious. With a high population of the aphids and an occasional diseased plant missed during the inspections, a quick spread of the virus can be expected. Nicotine sulphate (1:800 spray or 3 per cent. dust), Hexone (1:1600 spray) or a BHC product such as "Gammexane" (2 per cent. dust) control the aphid reasonably well. The aphids tend to stay on the lower leaves of the plant near the ground and thorough application of the spray or dust is therefore required in order to get a good kill. Treatment is normally required at fortnightly intervals during the growing season. Monthly treatment of the runner beds is also desirable.

Plate 32.
A Weir across the Lockyer.



The Side-gate Bail.

A. F. MOODIE, Division of Dairying.

A DEVELOPMENT which has gained much favour in the central dairying districts is the side-gate bail with lever-action control incorporated in the approved combined dairy building.

The accompanying sketches and plates illustrate both the design of the gate and the way in which it is used.

The advantage of this type of bail include—

1. Gates, not doors, are used.
2. The gates swing sideways, not into the race, leaving the race free of obstructions.

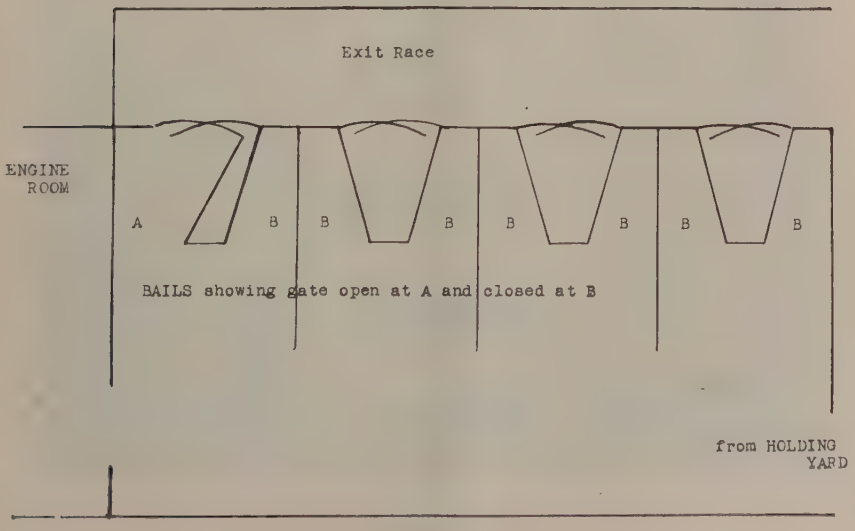
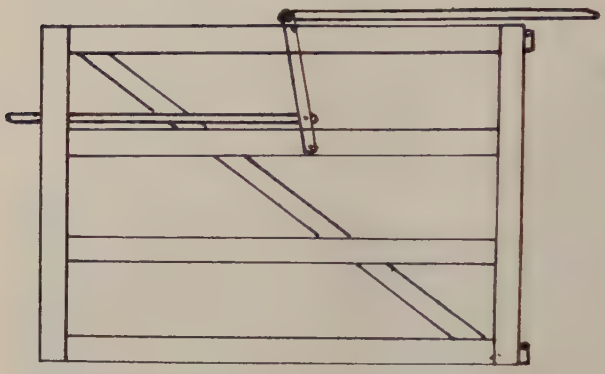


Plate 33.



SKETCH of Gate showing device for opening.

Plate 34.

3. As the gates are of open design, the race is under continuous observation.
4. With the gate at the side of the cow's head and not in front of her, there is little tendency for her to push through.
5. Cleaning of the shed is simplified.
6. The gate is easily operated by the lever shown in the sketch.

Plate 35.

The Side-gate Bail, with the Gate Closed.

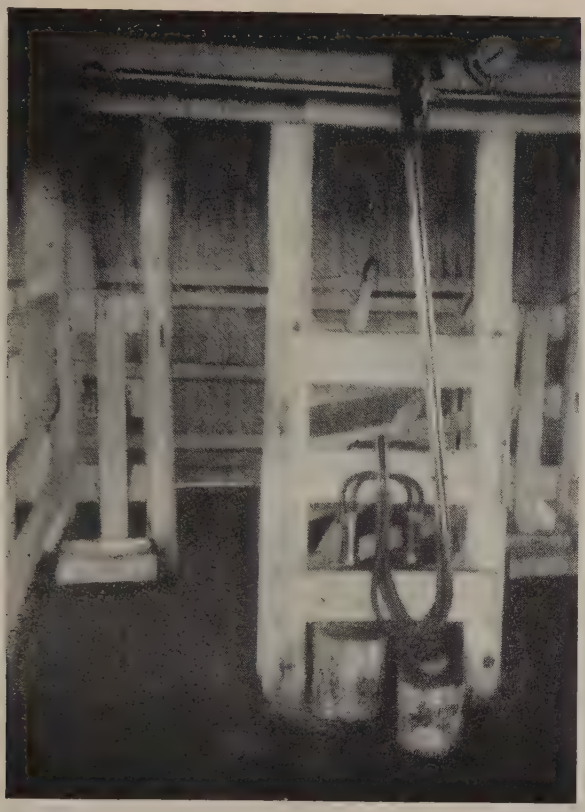


Plate 36.

The Side-gate Bail, with the Gate Open.

MAKE SURE THE SEPARATOR IS CLEAN.

Towards the end of the season and during the winter there is a tendency to slackness on a few farms in the attention given to the separator. This is probably due to the smaller quantities of milk being separated and to the shorter days, resulting in the separator not being washed after the evening skimming, or at best flushed out with cold water without being dismantled.

Periodical investigations in checking faulty cream supplies disclose that the carelessly washed separator is a frequent cause of inferior cream. Often the evening cream delivered to the factory will be of choice grade while the morning cream from the same farms will be graded as inferior. This is due to the evening cream coming from a clean separator washed during the day, and the morning cream from a separator that had not been properly washed the previous evening.

Apart from the risk of contamination, the loss of cream in the skimming may be three times greater than when a clean machine is used, because of the clogging of the discs.

The washing of the separator is not a great burden if a plentiful supply of boiling water is available and the work is done immediately separating is over before the milk dries on the parts.

The Beef Cattle Industry in the Far West.

J. C. J. MAUNDER, Chief Inspector of Stock.

(*Continued from page* 22, *July*, 1948.)

HERD MANAGEMENT.

Breeds of Cattle.

The Shorthorn holds undisputed sway throughout the entire area —no other breeds, or combination of breeds, are to be seen on any holding. Preference is shown towards the polled Shorthorn, due no doubt to the fact that every precaution has to be taken to minimise bruising of fats in transit to the far-distant meatworks. The Shorthorn, both polled and horned, has been found to be the most suitable for the large unfenced holdings where the very minimum of handling is practised. They appear to be the only cattle that will remain quiet under these conditions. Other breeds tend to become very wild, making them extremely difficult to muster and to drive.

Breeding Practices.

There are no stud cattle in the area, but herd bulls are purchased from outside studs, some in Central Queensland, some in New South Wales.

Those properties that depend primarily on store fattening do not run any herd bulls. On these properties, such propagation of the species as does occur is dependent upon the activities of "mickies" or male calves that have been missed in the previous musters. Incidentally, these "mickies" get some very fine calves.

All properties practise spaying, though it may not be done every year. The general principle is to spay out when the number of breeders on a property is considered to be too large for safety. It is amongst

the breeders that losses are heavy in drought times. Spaying is usually done "in a face" and there is practically no classing or culling. Cows and heifers are simply mustered, yarded and spayed out. It is decided that there are, say, 2,500 breeders on a property that should carry 1,000; therefore mustering and spaying progresses until 1,500 have been spayed out.

This practice applies particularly to those properties that are regarded primarily as bullock depots for fattening. On those properties where breeding is more extensive, spaying is practised with more regard to age and quality. The spaying is done by a contractor, who lives on the camp with the manager and stockmen until the job is completed; it takes about a week to spay out 1,500 head.

Plate 37.

Flank Spaying.—This method is practised on the smaller heifers where passage spaying would be difficult and slow. There is practically no difference in the time taken to perform the two operations. The disadvantage of flank spaying, of course, is the open wound, which is treated with the time-honoured tar-stick.

Passage spaying is performed for preference, but flank spaying is used on all females not sufficiently developed for the passage operation to be performed. Both methods are satisfactory when performed by a skilled, careful and fast operator (Plate 37).

Store Fattening and Breeding.

It is generally agreed that the most profitable part of the cattle industry is fattening, and therefore, most people prefer to fatten on country that will fatten. There is natural reluctance to breed cattle and sell them as stores for somebody else to benefit from the more profitable practice of fattening, when fats can be turned off.

In the Georgina-Diamantina country, the basic practice is to purchase stores and bring them in to turn off as fats. The exception

is with one large landholding company, which holds a string of properties along the Georgina and Diamantina, Farrars Creek and Coopers Creek into New South Wales and South Australia. In this case, no stores are brought into the Georgina and Diamantina holdings; what fats are marketed from those properties are bred there. Many stores move off these places, not for sale, but for movement through to the other properties en route to the ultimate market as fats. Advantage is thereby taken of variation of seasonal conditions in the different areas.

Plate 38.

MIXED CATTLE ON A GEORGINA PROPERTY.—Note the roan heifer in the foreground—a nice sample of baby beef. The cattle are walking out from water in the early afternoon, will probably return the following morning, camp and feed by the water and walk out again during the afternoon. As the summer comes on, cattle tend to camp all day by the waterholes, walk out to feed at dusk and return early again the following morning.

However, it is necessary to run some breeders on all properties with which the newly introduced stores can mix and settle down. In addition, in some years, owing to price and seasonal fluctuations it is not possible to get stores in. If no breeders were run, the turn-off of fats would be small in some circumstances. Running breeders and bringing in stores provides a double source of supply of fats—a necessary safeguard in a country where it is courting disaster to be completely tied to a single policy.

Introduced stores are brought almost exclusively from the Northern Territory. One pastoral company controlling three properties in the area also has a large run in the Territory where all its stores are bred. Another company has no holdings in the Territory but buys stores there whenever they are available and the prices and seasons are right. Most stores originate from Alexandria, Brunette, Austral Downs and Avon Downs, with some from Headingly.

Stores usually come in at 1½–2 years old, starting on the road in April–June and taking 6–10 weeks to reach their destination. With good seasons they may be got away as fats about July–August of the following year, but as a rule it takes two seasons after arrival to turn them off as fats.

These store fattening properties each bring in from 2,000 to 5,000 stores in a suitable season. A property which would bring in 4,000–5,000 stores would expect to turn off an average of 3,000 fats per annum in ordinary seasons.

Cattle Routines.

As pointed out previously, the runs are unfenced and cattle run almost at will, following the feed and water in accordance with the seasons. All classes—cows and calves, heifers, steers and bullocks—run together (Plate 38).

One general muster is held each year. This is done in sections, mustering through the run methodically. Practically all branding, earmarking and castration are performed in the broncho yards that are situated throughout the run. These general musters are attended by representatives from adjoining properties to claim any of their cattle and to earmark and brand their calves. Owing to the non-existence of boundary fences on most holdings, it is not uncommon for one adjoining holding to claim 1,500 head.

Mustering for fats is usually timed so that the fats go off during July and August. This is again a systematic muster, small mobs being put together and the fats cut out and moved along in the direction of the muster. The mobs have to be watched in camp at night, there being no yards for holding. On those occasions where broncho yards are used to hold small mobs, it seems to be the inevitable fate of the fences to be flattened and the mob to disperse.

The fats are not mustered into a bullock paddock, but are gradually made up into the average consignment of 500 and turned over to the drover for immediate movement towards railhead. Actually, in some cases the drover and his plant join up with the mustering camp and assist in putting the fats together and then finally move them off; this practice has much to commend it.

After all the fats have been cut out and started on the road, it may be necessary to start another muster to move off cows and calves to reduce stocking in anticipation of a dry period ahead. Follow-up of the general muster may take place if it is suspected that any considerable mob may have been missed during that operation. During all these musters, all the gear is transported from camp to camp by horse-pack and the job of horse-tailer is usually a full-time one.

Feeding Habits.

Beyond an attempt to save the feed around the permanent water as much as possible, little is done to control the feeding habits of the

cattle. In channel country while any lush feed such as native sorghum, clover, herbage, &c., is available, cattle naturally prefer to feed in the channels. As the feed dries off, they gradually move out on to the flood plains, existing then on the grassy feed. Should this fail, they finish up on the slopes of the sandhills, where they get a good picking of herbage and, as a final resort, dry spinifex.

In the open gravelly downs and plain country, cattle feed on the unsheltered plains and appear to fatten just as well as they do in the more sheltered sandhill country. In fact, cattle seem to fatten anywhere on whatever grows, provided the rate of stocking is kept down.

Drought Losses.

There is no doubt that over a period of years disastrous drought losses have occurred, and at least one herd of approximately 10,000 head has been completely wiped out twice in the last 30 years. Other herds, no doubt, have had similar experiences. Cattle numbers generally have declined over a period of 20 years. Some disastrous losses occurred as a result of the dry years of 1927, 1928, 1929, which followed a comparatively dry period from 1922–1927. Following these heavy losses, owners have been reluctant to stock as heavily as formerly.

The only safeguard against drought losses is obtained by regulation of the intake of stores, keeping down the number of breeders by spaying and the care and establishment of water facilities.

MARKETING OF CATTLE.

Fats Turned Off.

As mentioned previously, the main object of all owners is to market the maximum number of cattle as fats. The average number of fats that are turned off annually over a period of years is about 26,000 for the whole area. Although no annual figures are given, judging by the decline in cattle numbers from 1924 it is reasonable to assume that less fat cattle are turned off now than was the case 25 years ago.

Ages, Condition, &c.

Cattle bred on the Georgina and Diamantina, given just average seasons, make up into prime baby beef at 2–2½ years and would dress from 550–650 lb. In the best of seasons, they would dress up to 750 lb. Unfortunately, at this age, they would never walk the long distance to railhead (in some cases 450 miles) without excessive wastage to a weight at which killing would not be profitable. Occasionally in good seasons, with excellent feed along the stock routes, small numbers of these young steers may reach the market in good condition.

Stores usually come in at 18–24 months and require two seasons to turning off. Therefore, the earliest that station-bred cattle can be turned off is three years and Territory bullocks four years. Probably

the majority of bullocks are four to five years old before they reach the meatworks. The big seven-and eight-year-old bullocks that go to the works are usually those that have missed musters or have been kept back by the state of stock routes.

There is no doubting the quality of these bullocks and it is only the long trek to the treatment works that prevents their grading out at almost 100 per cent. first export quality.

Plate 39.

Fats on the Long Trek.—Part of a mob of 600 fats from the Georgina. Mostly five and six-year-old bullocks, they have completed the first 100 miles of a 460 mile walk to Quilpie, thence by rail to the works at Tenterfield. It is expected these would average in the vicinity of 800 lb. dressed weight. On the walk in, this mob would average about seven to eight miles per day.

In good seasons, when the fats are prime and there is ample feed on the stock routes, there is very little wastage on the trip in, but in less favourable seasons when the cattle are fat, without being prime, and when the stock routes are bare the wastage would be considerable, in the vicinity of 12–15 per cent. or nearly 100 lb. per beast.

The older bullocks (five to six years) walk in much better than the younger and unfortunately it is often necessary to hold them on the property, not until they are fat but until old enough to walk in to the rail head (Plate 39).

Fat Cattle Markets.

Seasonal conditions and the state of stock routes to a certain extent determine the markets to which fats will be forwarded. The works to which fats may be sent are Townsville, Cannon Hill, Wallangarra, Tenterfield and Adelaide. Unlike the Cooper output, very few cattle go to the Bourke works.

Properties on the upper reaches of the Diamantina and Georgina prefer to truck at Winton or Butru for Townsville works. Those on the lower reaches truck at Quilpie for Tenterfield, Wallangarra or Cannon Hill, and, until recent years, some trucked at Maree for Adelaide. The Adelaide market has, until recent years, been ahead of Brisbane and the New South Wales works, especially for cow beef. This difference is no longer pronounced and, therefore, fats only go that way if stock route conditions are more favourable for them than those used for the other markets.

There are no recognised markets for store cattle, which are only sold as such when dry conditions are anticipated. These sales are usually made to buyers who take delivery on the property and walk the cattle to their own holdings for fattening.

Difficulties of Marketing.

The greatest single limiting factor to the actual productivity of the country, in terms of fats marketed, is the difficulty associated with transport to works. As pointed out previously, distances from railhead are excessive and limit the class of beast that can make the trip. Stock routes (fuller reference to which will be made later) are not well watered and are often bare of feed. In some cases, a route cannot be used because there is no water on it, and in other cases there is water but no feed. It is sometimes necessary to puddle holes in the watercourse where surface water had dried out and bail water for the cattle.

Some mobs of fats are fed with lucerne hay along a route which has water but no feed. It is estimated that this requires 10 lb. of lucerne hay per head per day, feeding about every third day, on a trip of approximately 250 miles, which would take about a month to six weeks to complete.

In seasons where good floods have occurred in the channels, with no local rains, it often happens that thousands of fat cattle are ready to go off but the bare stock routes are impassable. Such cattle then have to be carried another season with all its risks.

When seasons are good, with plenty of feed and water along the stock routes, a six weeks' walk in does not worry the fats unduly and wastage is very slight. If well cared for on the road, they feed all the way to trucks. The long walk, however, combined with the train journey that would be not less than 400 miles and may be up to 650 miles (over 1,000 miles to the works in some cases) must have some considerable effect on the quality and sappiness of the meat. It is generally recognised, however, that fat cattle from the channel country are firmer and travel much better with less wastage, mile for mile, than cattle from, say, North Queensland.

[TO BE CONTINUED.]

A Pig Breeding and Feeding Programme for the Dairy Farm.

F. BOSTOCK, Officer in Charge, Pig Branch.

WHERE pig production is largely dependent on the dairying activities of a farm, careful planning of production is necessary to ensure that the dairy by-product, skim milk, is used to the best advantage. The farmer should as far as possible avoid being caught with an insufficient number of pigs to cope with the flush of skim milk; on the other hand, he should not be caught with a large number of pigs on the farm when skim milk is in short supply.

The following table has been drawn up to assist farmers in planning their pig raising operations. It applies to a 30-cow dairy farm, but dairy farmers with fewer or more cows will be able to use it as a guide. By following such a programme in a normal season, the farmer can obviate the purchase of stores during the flush of milk production and the sale of unfinished pigs because of insufficient feed.

Suggested Breeding Plan and Food Requirements of Pigs on a 30-cow Herd Dairy Farm.

Month.	Stock.	Separated Milk.	Meat meal.	Grain.	Fodder Crops Grain Equivalent. (*See* Note at End.)	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
July	No. 1 sow farrowed 5th July ..	As available	1	5	Grazing Green feed cut	Wheat, barley, oats, rape, grazing lucerne as available
	No. 2 sow with litter		1½	7		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 porkers from No. 3 sow ..		¼	4		
	6 slips from No. 4 sow		½	2		
	Daily Total		7¼	52		
	Total for 31 days		224¾	1,612		

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meat meal.	Grain.	Fodder Crops Grain Equivalent. (See Note at End.)	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
August	No. 1 sow with litter	As available	1¼	7	Grazing Green feed cut	Wheat, barley, oats, rape, mangolds, grazing lucerne as available
	No. 2 sow mated 10th August ..		¼	2		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 weaners from No. 2 sow ..		½–¾	1		
	6 light baconers from No. 3 sow ..		¾–1	5		
	6 porkers from No. 4 sow ..		¼	4		
	Daily Total		8	73		
	Total for 31 days		248	2,263		
September	No. 1 sow mated 10th September ..	..	¼	2	Grazing Green feed cut	Wheat, barley, oats, mangolds, grazing lucerne as available
	No. 2 sow dry	..	¼	2		
	No. 3 sow farrowed 5th September	1	¾	5		
	No. 4 sow dry	..	¼	2		
	6 weaners from No. 1 sow ..	1	..	1		
	6 slips from No. 2 sow	1	..	2		
	6 baconers from No. 3 sow (sell) ..	1	..	6		
	6 light baconers from No. 4 sow ..	1	..	5		
	Daily Total	25	1¼	95		
	Total for 30 days	750	37½	2,850		
October	No. 1 sow dry	1	..	2	Grazing Green feed cut	Lucerne, mangolds, grazing lucerne as available
	No. 2 sow dry	1	..	2		
	No. 3 sow with litter	3	..	7		
	No. 4 sow farrowed 5th October ..	3	..	5		
	6 slips from No. 1 sow	1	..	2		
	6 porkers from No. 2 sow ..	1	..	4		
	6 baconers from No. 4 sow (sell) .	1	..	6		
	Daily Total	26	..	88		
	Total for 31 days	806	..	2,728		
November	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow mated 10th November	1	..	1	4	
	No. 4 sow with litter	3	..	5	8	
	6 porkers from No. 1 sow ..	2	..	2	8	
	6 light baconers from No. 2 sow ..	2	..	2	12	
	6 weaners from No. 3 sow.. ..	2	..	½	2	
	Daily Total	42	..	35	152	
	Total for 30 days	1,260	..	1,050	4,560	

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meat meal.	Grain.	Fodder Crops Grain Equivalent. (See Note at End.)	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
December	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow farrowed 5th December	2	..	3	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow mated 10th December	1	..	1	4	
	6 light baconers from No. 1 sow	2	..	2	12	
	6 baconers from No. 2 sow (sell)	2	..	3	12	
	6 slips from No. 3 sow	2	..	1	4	
	6 weaners from No. 4 sow	2	..	½	2	
	Daily Total	53	..	45	200	
	Total for 31 days	1,643	..	1,395	6,200	
January	No. 1 sow farrowed 5th January	2	..	2	8	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow with litter	3	..	5	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 baconers from No. 1 sow (sell)	2	..	3	12	
	6 porkers from No. 3 sow	2	..	2	8	
	6 slips from No. 4 sow	2	..	1	4	
	Daily Total	43	..	45	168	
	Total for 31 days	1,333	..	1,395	5,208	
February	No. 1 sow with litter	3	..	5	8	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow mated 10th February	1	..	1	4	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 2 sow	2	..	½	2	
	6 light baconers from No. 3 sow	2	..	2	12	
	6 porkers from No. 4 sow	2	..	2	8	
	Daily Total	42	..	35	152	
	Total for 28 days	1,176	..	980	4,256	
March	No. 1 sow mated 10th March	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow farrowed 5th March	2	..	3	8	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 1 sow	2	..	½	2	
	6 slips from No. 2 sow	2	..	1	4	
	6 baconers from No. 3 sow (sell)	1	..	3	12	
	6 light baconers from No. 4 sow	1	..	2	12	
	Daily Total	41	..	45	200	
	Total for 31 days	1,271	..	1,395	6.200	

Suggested Breeding Plan and Food Requirements of Pigs on a 30-cow Herd Dairy Farm.—*continued.*

Month.	Stock.	Separated Milk.	Meat meal.	Grain.	Fodder Crops (Grain Equivalent). (See Note at End).	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
April	No. 1 sow dry	1	..	1	4	Sweet potatoes, pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow with litter	3	..	5	8	
	No. 4 sow farrowed 5th April	2	..	2	8	
	6 slips from No. 1 sow	2	..	1	4	
	6 porkers from No. 2 sow	1	..	2	8	
	6 baconers from No. 4 sow (sell)	1	..	3	12	
	Daily Total	31	..	45	168	
	Total for 30 days	930	..	1,350	5,040	
May	No. 1 sow dry	1	..	1	7	Pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	7	
	No. 3 sow mated 10th May	1	..	1	7	
	No. 4 sow with litter	2	..	6	7	
	6 porkers from No. 1 sow (sell)	1	..	3	7	
	6 light baconers from No. 2 sow (sell)	1	..	4	7	
	6 weaners from No. 3 sow	1	..	1	..	
	Daily Total	23	..	57	112	
	Total for 31 days	713	..	1,767	3,472	
June	No. 1 sow dry	1	..	1	7	Pumpkins, arrowroot, rape, grazing lucerne as available
	No. 2 sow farrowed 5th June	2	..	4	7	
	No. 3 sow dry	1	..	1	7	
	No. 4 sow mated 10th June	1	..	1	7	
	6 slips from No. 3 sow	1	..	1	7	
	6 weaners from No. 4 sow	1	..	1	..	
	Daily Total	17	..	19	70	
	Total for 30 days	510	..	570	2,100	

Note.—Grain equivalent: 1 lb. grain = 4 lb. sweet potatoes; 5 lb. arrowroot; 7 lb. pumpkins; 10 lb. green forage.

NEW CLUBS.

The Director of the Junior Farmers' Organisation (Mr. T. L. Williams) reports progress in the formation of Clubs in several farming areas as a result of visits paid some time ago to the Wide Bay and Callide Valley districts.

JUNIOR FARMERS' SCHOOL.

A second short-term course of instruction for some 30 members of various Clubs is being held at the State Agricultural High School and College at Lawes from August 23rd to September 3rd inclusive, the lads selected coming from as far afield as Biloela and Mackay. Lectures and practical demonstrations will again be features of the "school," with films and radio broadcasts being freely used to illustrate the various forms of instruction being given. Officers of the Department of Agriculture and Stock will be assisted by Mr. Williams and members of the teaching staff at the College during the fortnight's currency of the course.

EXAMINATION RESULTS.

At the close of the last "school" of instruction, examination test papers were sent out to each member who had attended. The following are the winners in their respective age groups:—

Over 17 years: 1st and silver cup—John Brooks, Lilydale, via Helidon; 2nd—Gordon T. Reid, Willowvale, via Warwick, Denis B. Doyle, Clinton Vale, via Warwick, Reg. Blanck, Ravensbourne, T. A. Smoothy, Pinelands, via Crow's Nest, and Stanley T. Fowler, Pittsworth (equal); 3rd—Edward Chapman and Benjamin R. Walsh, Goombi, Western Line (equal); 4th—Gordon T. McLennan, Willowvale, via Warwick.

Under 17 years: 1st and silver cup—Frank A. Rowen, Pittsworth; 2nd—Leo. R. Jones, "Sellamah," Kilkivan; 3rd—William F. Stillburn, M.S. 1135, Goomeri; 4th—Reg. O. Madsen, Yangan, Wm. McConnell, "Ann Drummond," Millmerran, and John R. Wanka, M.S. 130, Pittsworth (equal).

Book prizes dealing with some agricultural subject will be awarded the second-, third-, and fourth-place competitors in each division. Mr. Williams said the competition had been well worthwhile, proving a helpful guide to a boy's practical knowledge of agriculture. In addition it had acted as an encouragement for observation and study on the part of each boy concerned, and revealed his eagerness to become as efficient as possible in the "art of farming."

ESSAY COMPETITION.

Competition essays on the subjects of "Soil Conservation" and the "Use of Trees on the Farm" are now being written. The results will be made known in a subsequent issue of the *"Journal."*

SUMMER AGRICULTURAL SCHOOL FOR BOYS.

The Third Summer Agricultural School for boys attending State Primary and State Rural Schools will be held at the Queensland Agricultural and High School College from 3rd to 21st January, 1949.

The aim of the school is to make boys increasingly aware of their responsibilities and duties in living a more socially useful and healthful life in the home and community environment; to give training in leadership through active participation in and direction of games, discussions, and dormitory life; to develop their power of observing through increased knowledge of agricultural situations; to enable the boys to recognise problems and to know what they can do to resolve them.

Talks and practical demonstrations cover a wider field while specially selected and arranged films greatly extend the range of the boys' educational experiences. Day trips to the laboratories of the Department of Agriculture and Stock and of the Animal Health Station, to Dairy and Bacon Factories and to a stud farm also help to give knowledge of the complexity of agriculture beyond the home farm.

Membership of the school is restricted to boys from primary schools; and preference is given, though not restricted, to boys who live in farming and pastoral areas and who are members of Agricultural Project Clubs.

Nominations are to be made only through the Head Teacher of the local school and parents are advised to take early action through this channel.

The closing date for lodgment of nominations is 1st October. Boys will be notified of selection through their respective Head Teachers not later than 12th November.

MARKETING

Production Trends—July.

Generally mild and favourable weather prevailed in the dairying districts in July. Dairy stock have wintered well, water supplies are plentiful and there is a keen demand for springers due to farmers returning to the industry. Total butter and cheese production figures for the year 1947-48 in comparison with 1946-47 figures are set out in the following table:—

Year.	Butter.	Cheese.
	tons.	tons.
1946-47	33,079	7,719
1947-48	46,454	9,641

Good conditions were being experienced in all wheat-growing districts at the end of July and sowing had virtually been completed. The area sown for the 1948-49 wheat crop is estimated at 550,000 acres, which represents an increase of 10 per cent. on the 1947-48 acreage of slightly less than 500,000 acres.

On the Atherton Tableland harvesting of the maize crop was somewhat delayed by showery conditions. The crop in this area is expected to produce 17,000 tons.

In the northern tobacco areas seedbeds are making good progress, and fields are receiving final preparation in readiness for planting. Grading is still in progress in the Inglewood-Texas area, where the leaf harvested totals approximately 369,550 lb.

The outlook continues to be favourable in all cattle areas with the exception of the central-west, and it is expected that movements of reasonable numbers of fat stock will be maintained until the end of the current cattle season.

The outlook for sheep in the southern part of the State for August is good. Sheep in the Barcaldine district should maintain condition, but in the Longreach and Winton areas losses may be anticipated in station as well as travelling sheep.

Conditions throughout the pig producing areas of the State remain good and the demand for good quality breeding stock and stores is brisk.

World Meat Production.

The Food and Agriculture Organisation of the United Nations, in a recent publication entitled "Livestock and Meat," points out that meat production in Europe (excluding the U.S.S.R.) during 1947 was at about 60-65 per cent. of the pre-war level and only slightly higher than in 1946. Slaughterings in the United Kingdom, Denmark, Ireland, Sweden and Belgium were lower than 1946 figures.

In the leading exporting countries outside of Europe, aggregate production of meat in 1947 reached approximately the 1946 level, and was about 30 per cent. above the pre-war level, but some decrease was expected in 1948. In the United States, slaughter of cattle and calves reached an all-time record in 1947. In Argentine increased prices had led to relatively high slaughter, and Government action was taken in June, 1947, to restrict the slaughter of the better grades of cows and heifers.

In Australia, the extended drought in 1946 reduced numbers of every species and meat production in 1947 was below that of the previous year. Some improvement was expected for 1948. Canada's production was also down slightly on the previous year, and was only 75 per cent. of 1944's record production. In New

Zealand, cattle numbers have been increasing, and larger feed supplies available during 1947 are believed to have brought an expansion in pig breeding. Lamb and sheep numbers are also expected to increase during 1948 because of more favourable grazing conditions.

Brisbane Wholesale Markets.

Practically all varieties of vegetables were in particularly short supply throughout July, and prices reached what was probably an all-time "all-over" high for the Brisbane wholesale market.

Citrus fruits were in very heavy supply. Clearances of very small or medium to poor quality oranges were difficult to effect at payable prices. Strawberries were plentiful and sold readily at prices satisfactory to growers.

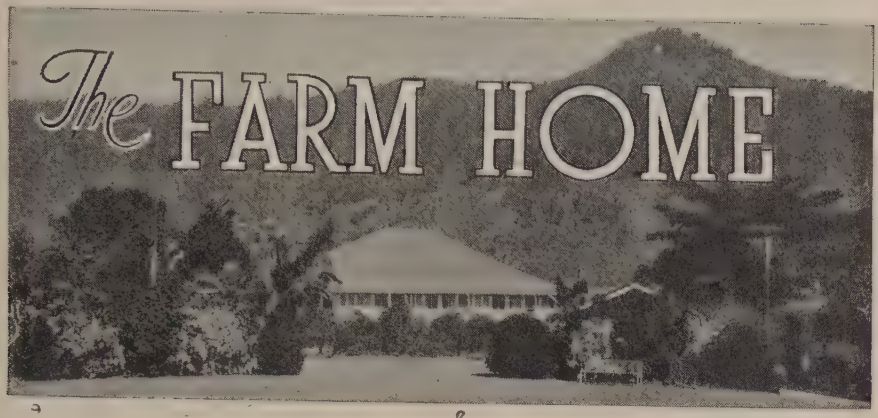
CURRENT FEEDING VALUES FOR MONTH OF JULY, 1948.

(Division of Animal Industry and Division of Marketing).

Feed.	Starch Equivalent Value per 100 lb.	Protein Value per 100 lb.	Average Wholesale Selling Price at Brisbane.	Cost per Starch Equivalent Unit.	Remarks.
Starch Concentrates.				d.	
Wheat	72	8	7s. 7d. per bushel ..	2·11	Supplies of maize and sorghum are very light and only small stacks of meals are available
Wheat meal ..	72	8	£14 13s. 4d. per ton	2·44	
Maize	78	8	7s. 9½d. per bushel	2·14	
Maize meal ..	71	8	£16 per ton (short)..	2·7	
Sorghum ..	71	7	£13 10s. per ton ..	2·03	
Sorghum meal ..	71	7	£13 10s. per short ton	2·28	
Barley	71	7	Not quoted		
Barley meal ..	71	7			
Oats	62	8	5s. 9d. per bushel ..	2·78	
Crushed oats ..	62	8	5s. 11d. per bushel	2·87	
Pollard	66	10	Not quoted		
Bran	56	10			
Molasses ..	50	1	47s 6d. per 44 gallons	2·59	
Protein Concentrates.					
Meat meal ..	80	55	Not quoted		
Linseed meal ..	72	25	Not available		
Peanut meal ..	78	43			
Blood meal ..	63	68	Not quoted		
Cottonseed meal	67	33	Not available .		
Roughages.					
Lucerne hay and chaff	40	10	Hay £6 10s. per ton	1·74	Wheaten : Very scarce and lacking quality. Lucerne : Mostly poor to inferior hay was offered while the quality of the chaff was fair to medium. Oaten : Supplies arriving from Wagga were very light, which accounted for the increased demand for local consignments.
			Chaff £10 10s. ton ..	2·81	
Oaten hay ..	33	3	£8 5s. per ton ..	2·67	
Wheaten hay ..	33	3	Not available		
Oaten chaff ..	40	3	Local £12 per ton ..	3·21	
Wheaten chaff ..	40	3	Local £10 per ton ..	2·67	

Mineral Supplements.

Ground calcium carbonate (limestone), not quoted.
Bone meal, £11 per ton.
Bone flour, not quoted.
Shell grit (dicalcic phosphate). 4s. per bag (40 lb. approx.).



Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

PARENTS AND A CHILD'S OBEDIENCE.

THE question of children's obedience is often a vexed one as far as families are concerned and there is no doubt that many mothers and fathers have never given any real thought to the importance of it. Actually parents should before, or at least as soon as their first baby is born, talk the whole question over and settle between themselves what their attitude is to be. *Obedience should apply to important things only*—on unimportant matters children should be given a reasonable amount of freedom. Obedience depends so much on mother and father making *worth-while* demands —not petty ones—and it also depends on their love for the children and their own sense of justice and calmness and firmness.

It is also worth while to explain to children whenever possible why mother or father insists on certain things being done. Children are quite reasonable beings and many a child fails to obey because he cannot understand "why." Commands should only be given when necessary and not just to show authority or to "work off" feelings of anger.

Try to make your commands positive instead of filling them with "don'ts." A sign in the park reading "Please walk on the path" is much more effective than "Keep off the grass." A kindly request is much more likely to be successful with children as with grown-ups. The parent must first be sure he or she is right and then be firm. It is most disturbing to a child to be allowed to do a thing one day and be forbidden to do it the next.

Another important point is that in teaching a child obedience mother and father should present a united front to the child. If they do not agree they must settle their differences away from the child, not in front of him. Otherwise he will quickly learn that one parent can be coaxed to allow what the other refuses. "Mother is right, Sonny," or "You must do what Daddy says" is the right attitude to take.

Do not expect a healthy child to obey commands like "Sit still," "Be quiet," or "Stop fidgeting." These are impossible and unreasonable. Children cannot be quiet and one should not expect them to be.

Another wrong way is to shame, tease, or frighten a child into obeying. This may do more harm than a smacking, which is not usually a good way either. Children should be taught to obey because it is right, not just because they are afraid of being punished.

Always try to find out what is in the child's mind and what he thinks he is doing before correcting him. Many a time a child has the right idea but his method of carrying it out is wrong. Disobedience in children is often the parents' fault and

if a child is constantly disobedient advice should be sought from a children's doctor or the Sister at your Welfare Centre, who will help mother and father to sort out where they have gone wrong in the child's management.

Any further advice on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

IN THE FARM KITCHEN.

Stuffed Pumpkin.

Requirements.—A small pumpkin, well-shaped; ¾ to 1 lb. cold meat; 1 teacup fine soft breadcrumbs; 1 oz. dripping; 1 oz. flour; ½ pint water; few drops Parisian essence; ½ teaspoonful meat extract; ½ teaspoon onion salt; 1 teaspoon tomato sauce; ¼ teaspoon Worcester sauce; salt, pepper; 1 teaspoon chopped mixed herbs (if liked); about 2 cups cold mashed potato; milk; bacon to garnish.

Method.—

If you have half a pint of left-over gravy, use that instead of making more. Season it with a little tomato and Worcester sauce.

1. With a sharp knife cut rind off pumpkin. Place it to stand in the firmest way and then cut centre piece out of the top. If hole is too small you will have difficulty in removing the soft centre and seeds. Use metal spoon to scrape all that part away and feel with your fingers to make sure you have removed it all.

2. Make gravy as follows:—Melt the fat in a saucepan. Add flour and blend smoothly with wooden spoon. Stir in water by degrees at first. Add sauces and meat extract, colouring, onion salt, and salt and pepper. Stir and boil for three minutes.

3. Put meat through a mincer and turn it into a bowl. Make breadcrumbs and press them through a wire strainer. Mix with meat and add gravy and herbs and mix thoroughly.

4. Fill the pumpkin with mixture almost to top. Mash a little milk into the cold potato and pile it over the hole. Mark with a fork.

5. Have ready a moderate oven and a baking dish with a little boiling fat in it. Put the pumpkin into this and baste sides with the boiling fat.

Bake for about an hour and a-half till cooked through when tested with a skewer. Baste frequently during cooking, reducing the temperature after about an hour to prevent the pumpkin from being over browned.

Cold Fish Mould.

Half pound of any cooked fish, ½ lb. mashed potato, 1 tablespoon raw grated beetroot, 1 dessertspoon chopped parsley, 2 tablespoons thick salad dressing, salt and pepper. Mix all the ingredients well together, and pack into a damp pudding basin or mould, pressing the mixture well down and filling it right to the top. Place a plate or saucer on the top, with a weight to keep it firmly in position, and leave in a cool place for at least two hours, or overnight. Turn out carefully, and serve with salad.

Cold Meat Pie.

Any kind of canned meat or stewing meat, well seasoned. Cook stewing meat or steak, if this is used, seasoning it with herbs and chopped onion, ½ lb. self-raising flour, a good pinch of salt, 3 oz. lard or bacon fat, 5 tablespoons water, pastry. Line a round cake tin with the pastry. Put in the filling, add a little vegetable stock or, if using stewing steak, some of the gravy. Brush edge of pastry with cold water and place a round of pastry on the top, pressing it gently and arranging the pastry so that about half an inch stands up all round. Flute the edges, make a slit in the centre of the pie and bake for half an hour in a moderate oven.

Spicy Fruit and Meat Pie.

Mince lean cold mutton finely and mix in an equal quantity of fat meat and add 4 oz. raisins, ½ lb peeled chopped apples, 4 oz. sultanas, 2 oz. moist sugar, salt and nutmeg. Put the mixture into a well greased piedish, make a pastry cover and bake in a hot oven.

QUEENSLAND WEATHER IN JULY.

Rainfall distribution during July favoured those divisions which hitherto have been experiencing a dry spell, viz., the Carpentaria, Central and Upper Western divisions, where above-average totals were received, thus providing temporary relief. However, in these latter areas, further rains in the near future will be required to promote the spring growth of herbage and thus ensure summer feed. Above-average totals were also recorded in the Peninsula, North Coast and Central Coast East divisions. In divisions not mentioned above, rainfall was below average with the exception of the Darling Downs West, but the ample early winter rains received have maintained good winter fodder and the country generally in these areas is in good condition. On the Darling Downs area, the fine weather spell has allowed wheat crops to germinate and become established, and prospects for a good crop are bright. The over-average rains registered in inland areas were associated with rainfall activity from the 5th to 6th, 11th to 13th and on the 17th. From the 5th to 6th, all districts with the exception of parts of the Carpentaria, Western and South-Western districts received falls ranging from approximately 50 points to 2 inches. Falls during the period 11th to 13th occurred in the same areas but were more variable and scattered in distribution, varying from very light amounts to 1½ inches. Rainfalls reported inland on the 17th were confined to the western portions of the Carpentaria and Western Divisions, where fairly general falls from ½ inch to 1½ inch occurred. On the coastal areas, falls were spread fairly evenly over the month and were associated with scattered light to moderate shower activity, especially along the North Coast.

Pressure.—The first half of the month was characterized by further pronounced tropical dip and trough features which reached their maximum activity from the 5th to 6th, 11th to the 13th and on the 17th when the good inland rainfall distributions, referred to above, all occurred. This unseasonal tropical activity has been very persistent during the whole of the winter, and can be held responsibe for the best winter rainfall aggregates received in the South-West and South Border divisions since the winters of 1920 and 1921. The situations from the 4th to 6th and 11th to 13th were somewhat similar in that typical tropical dips developed from the Gulf of Carpentaria to the Southern border giving a deep flow of moist tropical air over inland Queensland. Condensation from this tropical air occurred when vigorous southern depressions and their associated cold fronts extended their influence into the Queensland region. The rainfall registered on the 17th was associated with an upper level rather than a surface situation, which moved into Western Queensland from Central Australia. In the latter case, however, the moist tropical air was still present at lower levels. During the second half of the month both the tropical influences and southern depressions decreased in activity and the typical winter type of pressure control asserted itself.

Temperatures.—Maximum temperatures were slightly above normal in the Peninsula and inland divisions with the exception of the Western, South Western and Maranoa divisions. All coastal areas again recorded below-average readings. Minimum temperatures were above normal in all divisions except the Upper Western, parts South Western, Maranoa and parts of the South Coast Port Curtis division. Many frosts were reported in the south-eastern quarter of the State, especially on the Darling Downs and adjacent areas, where they were practically continuous during the second half of the month with some very sharp temperatures. The Central and South Western districts also experienced increased frost activity as compared with the previous month. The centre in which most frosts occurred was Stanthorpe, 28 days (lowest temperature on 8th 18 degrees in screen, 7 degrees on grass this being lowest terrestrial since 7 degrees on 6/7/46, lowest on record being 5.7 on 19/7/33).

The rain position is summarised below:—

Divisions.	Normal Mean.	Mean July, 1948.	Departure from Normal.
	Points.	Points.	Per. Cent.
Peninsula North	42	42	..
Peninsula South	24	47	96 above
Lower Carpentaria	20	57	185 ,,
Upper Carpentaria	42	80	90 ,,
North Coast, Barron	114	158	39 ,,
North Coast, Herbert	179	250	40 ,,
Central Coast, East	111	126	14 ,,
Central Coast, West	65	63	3 below
Central Highlands	116	198	71 above
Central Lowlands	82	120	46 ,,
Upper Western	41	64	56 ,,
Lower Western	51	28	45 below
South Coast, Port Curtis	178	170	5 ,,
South Coast, Moreton	227	89	61 ,,
Darling Downs, East	181	153	16 ,,
Darling Downs, West	141	151	7 above
Maranoa	147	134	9 below
Warrego	107	103	4 ,,
Far South-West	69	47	32 ,,

Commonwealth of Australia, Meteorological Bureau, Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

OCTOBER, 1948.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.29	5.47	Cairns	36	22	Longreach	38	31
6	5.23	5.49	Charleville ..	28	26	Quilpie	34	36
11	5.18	5.52	Cloncurry	55	45	Rockhampton ..	13	7
16	5.13	5.55	Cunnamulla ..	29	30	Roma	18	16
21	5.7	5.58	Dirranbandi ..	18	20	Townsville ..	30	19
26	5.3	6.1	Emerald	22	16	Winton	44	36
31	5.0	6.4	Hughenden ..	40	30	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	a.m.	p.m.
1	4.25	4.02
2	5.02	5.10
3	5.38	6.17
4	6.13	7.24
5	6.51	8.30
6	7.31	9.36
7	8.16	10.40
8	9.04	11.40
9	9.57	..
		a.m.
10	10.52	12.35
11	11.49	1.23
12	12.46	2.05
	p.m.	
13	1.41	2.42
14	2.34	3.14
15	3.27	3.44
16	4.19	4.12
17	5.12	4.39
18	6.06	5.08
19	7.02	5.37
20	8.01	6.10
21	9.02	6.48
22	10.04	7.31
23	11.05	8.22
24	..	9.20
	a.m.	
25	12.02	10.23
26	12.54	11.29
		p.m.
27	1.39	12.37
28	2.20	1.44
29	2.57	2.51
30	3.32	3.56
31	4.07	5.01

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	23	30	39	5	14	34	44
6	27	12	43	26	18	1	51	29
11	29	10	45	24	20	0	52	27
16	19	17	36	33	10	8	41	37
21	11	28	26	43	0	19	28	51
26	11	28	26	43	0	19	28	52
31	21	15	37	31	12	7	43	35

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	19	37	42	56	27	41	17	32
3	31	24	51	46	35	32	25	21
5	43	12	59	38	44	24	36	12
7	52	4	66	33	50	19	43	5
9	56	2	68	32	52	17	46	3
11	53	4	67	33	50	19	44	5
13	45	10	61	37	46	23	37	10
15	35	20	54	44	39	29	29	18
17	26	30	47	50	32	35	22	25
19	16	39	41	57	26	42	14	34
21	7	49	36	63	20	49	7	41
23	2	55	33	67	17	52	3	45
25	3	53	34	66	18	51	4	44
27	11	45	38	60	23	46	10	37
29	21	33	44	54	29	38	18	29
31	34	21	53	44	38	29	28	18

Phases of the Moon.—New Moon, 3rd October, 5.42 a.m.; First Quarter, 10th October, 8.10 a.m.; Full Moon, 18th October, 12.33 p.m.; Last Quarter, 25th October, 11.41 p.m.

On 15th October the Sun will rise and set approximately 10 degrees south of true east and true west respectively; and on 2nd and 17th October the Moon will rise and set approximately at true east and true west respectively.

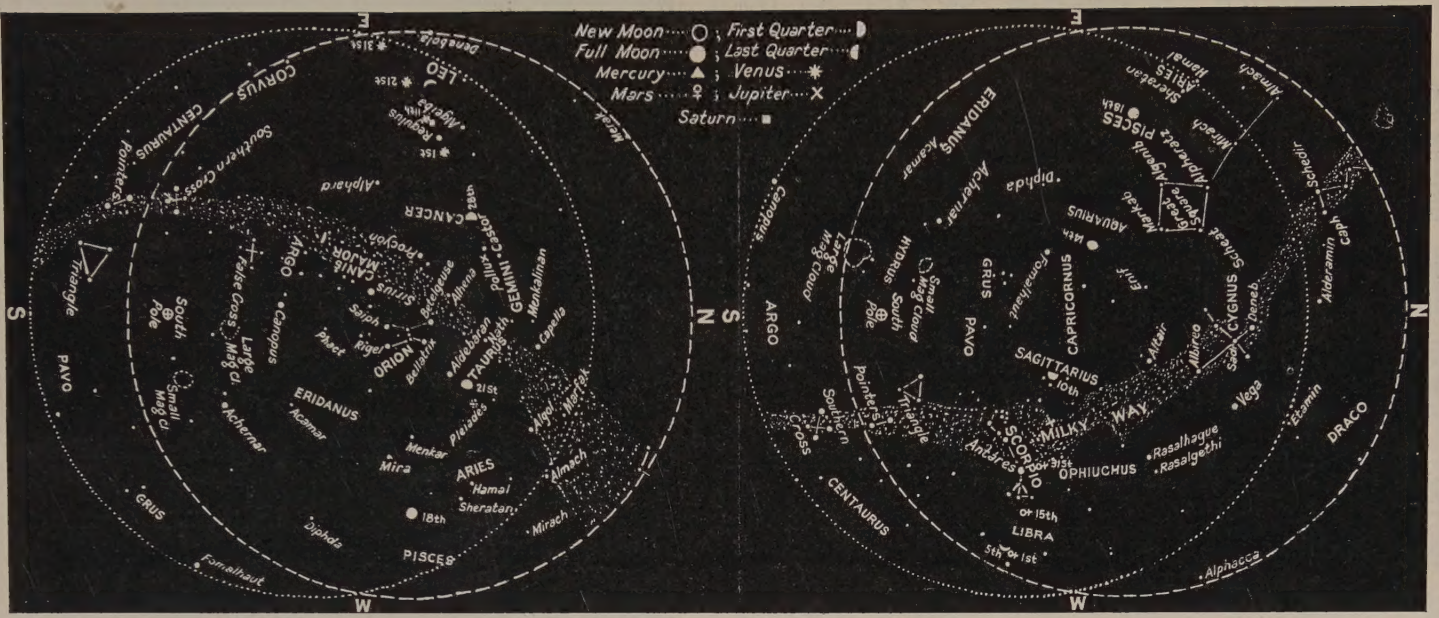
Mercury.—In the constellation of Virgo at the beginning of the month, when it will set about 2 hours after the Sun. By the 20th it will be in line with the Sun, after which it will become a mornng object and by the 31st will rise about ¾ hour before sunrise.

Venus.—A morning object in the constellation of Leo at the beginning of October, when it will rise between 3.20 a.m. and 4.30 a.m. On the 5th it will pass less than 1 degree south of Regulus and on the 8th about 1 degree south of Saturn. By the end of the month, in the constellation of Virgo, it will rise between 3 a.m. and 4.15 a.m.

Mars.—At the beginning of the month, in the constellation of Libra, will set about 3 hours after the Sun, and at the end of the month, in the constellation of Scorpio, will set about 2½ hours after sunset.

Jupiter.—Still an evening object, and on the 1st will set a little before midnight, while on the 31st, in the consteliation of Sagittarius, it will set between 9.45 p.m. and 11 p.m.

Saturn.—Now a morning object in the constellation of Leo. On the 1st it will rise between 3.45 a.m. and 5 a.m. and on the 31st between 2 a.m. and 3.15 a.m.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory border on the 15th October. (For every degree of longitude we go west the time increases by 4 minutes.) The chart on the left is for 9 hours later. On each chart the dashed circle is the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom, and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

JULY.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July	No. of years' records.	July 1947.	July 1948.		July	No. of years' records.	July 1947.	July 1948.
North Coast.	In.		In.	In.	*South Coast—cont.*	In.		In.	In.
Atherton	1·12	42	0·79	1·61	Gatton College ..	1·37	44	0·06	..
Cairns	1·53	61	1·40	2·59	Gayndah	1·47	72	0·09	1·83
Cardwell	1·38	71	1·00	1·58	Gympie	2·07	73	Nil	0·86
Cooktown	0·98	67	1·74	1·01	Kilkivan	1·50	62	0·15	0·77
Herberton	0·89	57	0·40	1·14	Maryborough ..	1·93	72	0·02	1·37
Ingham	1·69	51	0·79	1·91	Nambour	2·67	47	0·87	1·01
Innisfail	4·75	62	2·84	7·66	Nanango	1·65	61	0·15	0·99
Mossman	1·19	19	1·73	3·05	Rockhampton ..	1·73	72	0·20	1·51
Townsville .. .	0·67	72	Nil	1·07	Woodford	2·28	55	0·11	0·41
Central Coast.					*Central Highlands.*				
Ayr	0·73	56	Nil	0·78	Clermont	1·06	47	Nil	2·20
Bowen	0·93	72	0·08	0·35	Springsure	1·18	74	Nil	2·09
Charters Towers ..	0·67	61	Nil	0·48					
Mackay	1·64	72	0·18	2·85	*Darling Downs.*				
Proserpine	1·58	40	0·63	1·41	Dalby	1·71	73	0·08	1·27
St. Lawrence ..	1·36	72	Nil	1·74	Emu Vale	1·57	47	0·42	1·13
					Jimbour	1·48	64	0·18	1·34
South Coast.					Miles	1·62	58	0·05	1·58
Biggenden	1·41	44	0·37	1·30	Stanthorpe	2·00	70	1·16	1·33
Bundaberg	1·83	60	0·22	2·11	Toowoomba	2·06	71	0·16	1·58
Brisbane Bureau ..	2·16	95	0·34	0·53	Warwick	1·80	78	0·55	1·35
Caboolture	2·37	67	1·22	0·58					
Childers	1·70	48	0·22	1·31	*Maranoa.*				
Crohamhurst	2·90	50	0·17	0·86	Roma	1·43	69	Nil	1·09
Esk	1·90	56	0·08	0·64	St. George	1·21	62	0·41	1·26

CLIMATOLOGICAL DATA FOR JULY.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric pressure. Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Pts.	
Cairns	..	78	64	82	27	57	19	259	11
Herberton	..	71	52	77	23	39	19	114	9
Townsville	..	76	60	82	13, 23	48	20	107	6
Rockhampton	30·15	73	49	81	28	41	19, 20	151	4
Brisbane	30·17	69	48	74·2	22	36·8	21, 24 8	53	7
Darling Downs.									
Dalby	..	65	36	74	27	25	7	127	6
Stanthorpe	..	59	30	67	1, 27	18	8	133	8
Toowoomba	..	61	36	68	1	24	8	158	7
Mid-Interior.									
Georgetown	..	85	58	91	28	45	25	100	4
Longreach	30·17	74	47	84	26, 28	38	30	65	1
Mitchell	30·22	65	35	76	26	28	4	101	3
Western.									
Burketown	..	84	57	89	28	48	24, 25	29	2
Boulia	30·08	72	46	81	26, 31	34	7	59	2
Thargomindah	30·18	65	39	79	31	32	8	49	1

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Deputy Director, Meteorological Services

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